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POLICY OPTIONS FOR STABILIZING GLOBAL CLIMATE

HEARING

BEFORE THE

SUBCOMMITTEE ON
ENVIRONMENTAL PROTECTION

OF THE

COMMITTEE ON
ENVIRONMENT AND PUBLIC WORKS
UNITED STATES SENATE

ONE HUNDRED FIRST CONGRESS

FIRST SESSION

MARCH 17, 1989

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POLICY OPTIONS FOR STABILIZING GLOBAL CLIMATE

FRIDAY, MARCH 17, 1989

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
SUBCOMMITTEE ON ENVIRONMENTAL PROTECTION,
Washington, DC.

The subcommitee met, pursuant to notice, at 10:06 a.m.,in room 406, Dirksen Senate Office Building, Hon. Max Baucus [chairman of the subcommittee] presiding.

Present: Senators Baucus, Lieberman, Chafee, and Humphrey.

OPENING STATEMENT OF HON. MAX BAUCUS, U.S. SENATOR FROM THE STATE OF MONTANA

Senator BAUCUS. The hearing will come to order.

I would like to first welcome our guest, Bill Reilly, who has testified before this committee twice in the past six weeks.

There is probably no greater problem facing the Earth today than that posed by the specter of global warming. The gasses that our modern industrial society spews into the atmosphere by burning fossil fuels, cooling our buildings, and through other means, are trapping heat in the Earth's atmosphere and warming the planet.

How much warming will these greenhouse gasses cause? What will be the effect of this warming? The future impact of global warming is very difficult to predict, but left unchecked, global warming will leave us a world much different from the world that exists today.

We can project a raised sea level. We can project that some areas will become drier and others will become wetter. We can project the reoccurrence of drought, like last Summer's devastation. We really do not understand the environmental consequences of these changes. We do not know what this means in terms of human suffering.

We are moving into a future which we cannot predict and for which no analog from the past exists. Yet, there is cause for some hope. Actions of the Montreal Protocol and the just concluded London Conference demonstrate an international commitment to the complete phase-out of CFCs.

Bill Reilly is part of a new Administration that has offered strong words in support of a phase-out of chlorofluorocarbons. Recent data indicates that the problem of climate change is worsening. Just a few weeks ago, NASA and NOAA concluded that the possibility of an Arctic ozone hole is no longer a question of if—but

when. Today's hearing will focus on global air pollution, but we will also address the larger question of whether or not the United States can assume a leadership position in addressing what most consider a big problem with catastrophic consequences.

Bill, I know that you understand the gravity of the situation. During your confirmation hearing, you spoke of the present as, "An historic moment, characterized by urgency and also by opportunity." We welcome you today so that you can go beyond the words and act on the opportunity and so we can develop a plan for action.

I expect to learn first-hand about what is happening both here at home and internationally with CFCs. I further expect to learn about policy options to stabilize the global climate. We are concerned about the timing of such responses, and finally, about exploring with you how we can best move forward.

The Policy Options Report makes the compelling argument for action now. The question confronting us is: will we heed this warning? Some will ignore it, as warnings concerning CFCs were ignored and policy makers were lulled into inaction because of the guise of the facts.

The price of waiting has been high. Our delay in phasing out CFCs has exposed current and future generations to increased exposure to ultraviolet radiation. We do not know just how damaging increased exposure to ultraviolet radiation will be. We do know that increased incidents of skin cancer, immune system breakdown, increased cataracts, and upheavals of the earth's ecosystems are the beginning of that damage.

For naysayers who ask for more data to measure just how much the global climate is changing, the Policy Options Report holds a simple promise: if we wait for proof beyond any doubt, it will be too late to take preventive steps. Without action now, the Earth will experience a 40 percent increase in warming by the year 2050 over what it otherwise would have been.

The United States is the largest single source of greenhouse gasses. The amount is significant, but it only represents about 20 percent of the greenhouse emissions globally.

We cannot solve the problem alone. We must act if we want other countries to act. Our domestic initiatives must demonstrate our commitment to respond to global climatic changes.

The challenge that all of us must face as we confront global warming is: how can we move the United States toward less wasteful ways and lead the world into environmentally safe growth? The EPA report that we have asked you to comment on today shows that there is such a path.

Limiting all CFCs would be a first step. Stopping production and emission of CFCs into the environment would reduce greenhouse gasses by 20 percent, but we can not stop there.

Carbon dioxide is a pollutant, and we must control its emission into the atmosphere. We must consider methane a pollutant and control its emission as well. We need to aggressively pursue measures to make our cars, trucks, homes, and factories more efficient, and we must direct the scientific and technological capabilities of the Nation toward finding new environmentally safe methods to produce energy.

If we fail in this task, it will be difficult for others in the world to follow. We have the opportunity.

We want to work with you, Mr. Reilly, in helping the Congress, the Administration, and the private sector in the development of these solutions. Again, welcome to our hearing.

Senator Chafee.

OPENING STATEMENT OF JOHN H. CHAFEE, U.S. SENATOR FROM THE STATE OF RHODE ISLAND

Senator CHAFEE. Thank you, Mr. Chairman. First of all, I want to thank you for holding this hearing on such short notice.

As you noted, in recent weeks scientists and policy makers all over the world have been spending an enormous amount of time and energy on the related problems of global climate change and the problems dealing with the destruction of the ozone layer. Things have been moving quickly, and it seems to me that this is a good opportunity for us to find out what is taking place and where we go from here.

I think it is fitting that the first meeting of this subcommittee this year since you have taken the helm, Mr. Chairman, is on this particular subject, global environment problems. Anyone who has followed the work of this committee knows that you, Bill Reilly, and I have been wrestling with these issues for some time.

We appreciate your being here, Mr. Reilly, and I just want to review the bidding a little bit. I was privileged to be chairman of this subcommittee when we first had our hearings on global environmental problems in June of 1986, over two years ago.

It was clear to me then, as it is now, that we are facing a serious threat. The scientists are telling us that if we continue to stroll along as if everything were fine, we will transform Earth into a planet that will not be able to support life as we now know it.

At that time, I asked the experts what we should be doing to reduce the threat of this massive global climate change, and I was surprised to learn that no one had done a detailed analysis of our policy options. I asked Lee Thomas, the then EPA Administrator, and the Congressional Office of Technology Assessment to prepare an analysis and report.

Earlier this week, the draft of EPA's report was made available to us, and anybody who has seen that report, I think will agree that it is powerful stuff. As the draft report goes through interagency review and is examined by your Science Advisory Board, I expect that people will challenge some of the details and statistics.

I believe that it will be difficult to challenge and disagree with the underlying message. The message, as I get it, is that policy choices and investment decisions made now could slow the rate of pollution and climate change enough to avoid a catastrophe. On the other hand, the longer we wait, the more difficult and costly it will be to cope with these changes.

The report confirms the fact that technology exists now to make a difference. As a result, the future is clearly in the hands of all of us. This is not a hopeless situation.

Having had some success with that June, 1986 proposal, I am going to try a new one on you, Mr. Reilly. See if you agree with

this, and if you do, feel free to endorse it. If you do not, think it over and come on back.

Here is my suggestion. During the first week of November, the Dutch Government is hosting a meeting at the Hague for the Environmental Ministers from 60 countries. They will be discussing global warming, including the need for a treaty or a convention on the protection of our global climate. That meeting presents President Bush with an excellent opportunity to demonstrate global leadership on the environment.

Here is the specific proposal. First, the President should immediately endorse, as a national goal and as a goal for other industrial nations, a 20 percent reduction in carbon dioxide emissions by the year 2000. Second, he should use the time between now and October first to develop and submit to Congress a series of specific proposals to achieve the needed reductions in the United States. Third, he should use the time between now and November to persuade other countries to endorse this goal of the 20 percent reduction by the year 2000.

I am urging the President to work with his counterparts in other countries in settings such as the Economic Summit Meeting of the Seven Industrialized Nations, to be held in Paris in July, and to get commitments from them. I am going to put this proposal in writing and send it to the President, and for my colleagues who want to endorse this, I will circulate it for signatures. In addition, I will write the National Governors Association, the National Conference of Mayors, the National Association of State Legislators, and the National League of Cities, because it seems to me that all of them are also involved in this effort. They can help us solve the problem, and I will be urging them to design and implement 20 percent reduction plans as well.

Here is an opportunity for all the creative ability that exists, not only in your Department but also in those various other entities of government that I previously mentioned and in this committee, to get on with trying to solve this very, very difficult problem. It is going to take a lot of effort and it is not going to be done overnight.

Thank you very much, Mr. Chairman.

Senator BAUCUS. Senator Lieberman.

OPENING STATEMENT OF HON. JOSEPH I. LIEBERMAN, U.S. SENATOR FROM THE STATE OF CONNECTICUT

Senator LIEBERMAN. Thank you, Mr. Chairman. Let me join in thanking you for convening this hearing today so quickly in response to this report from EPA.

Through your leadership, you make very clear how seriously this committee views the problem of global warming. Let me also acknowledge the farsighted leadership of Senator Chafee on this issue before it became a problem that people were more generally concerned about.

I have a statement which I ask would be included in the record, but let me briefly summarize. It seems to me that what we are talking about here today might still sound to many people like science fiction.

One of the EPA reports that I looked at suggested that if we do not act, by the year 2100, the temperature could rise by almost six degrees Celsius, 12 degrees Fahrenheit, generally speaking. If I am correct, during the Ice Age, the temperature on the planet dropped by about five degrees Celsius from where we are now, so we are talking of something that is not natural evolution of environmental facts, but is rather the dramatic man-made alteration of the natural environment beyond what it seems able to absorb.

The question really is whether or not we will act to alter the course that we are on. The scenarios that are sketched out in the EPA report are vivid and electrifying, and I know that I will not be here on this planet long enough to see the full consequences of it, but this is really a call to farsighted leadership to do what is our responsibility as lawmakers, which is to protect the generations of our children and their children who will follow us.

Someone said that change is the one constant that we can be certain of in our lives, and that is true. The world that all of us grew up in has changed dramatically, but the scope and speed of the changes that are talked about in this report and on this subject are truly unprecedented. We have got to act to do something about them.

Also, we must change the way that we have viewed environmental protection. We have tended to see it as a problem that we can handle through regulation and law enforcement whose consequences were local, in a comparative sense.

This document, in very clear terms, says that we have got to break out of that mind set and be very bold in our examinations of the potential responses to the problem, because some of them go fundamentally to our life style. Changes must come in the way in which we live.

I wanted to compliment the staff at EPA for their effort in this report to bring clear-headed attention to a difficult problem. This is a report that has bad news and good news in it. The bad news is that if we continue in the way that we are going, life as we know it on this planet is going to change dramatically. The good news is that there are solutions that we have reason to believe can alter the course we are now on.

The pressing news that comes out of this report is that we pay a consequence for delay. The longer we wait, the harder it is going to be to deal effectively with these problems, so I thank EPA for acting with real vision here, and I thank the chairman for convening this hearing. I hope that working together, we can take some of the steps that are necessary to protect the world in which we live and in which we want our kids to live.

Thank you, Mr. Chairman.

[Senator Lieberman's written statement follows:]

OPENING STATEMENT OF HON. JOSEPH I. LIEBERMAN, U.S. SENATOR FROM THE STATE OF CONNECTICUT

Mr. Chairman, I thank you for convening this hearing today in response to important information which has just become available to us from the Environmental Protection Agency. Through your leadership you demonstrate how seriously this committee views the problem of global warming.

What we will be talking about here today might sound to some like science fiction. But the events we will discuss are likely to become reality in the future unless we act. Not in one dramatic moment, but in an evolutionary fashion over the course of decades. How this future unfolds depends on what we and the rest of the world do now.

EPA has given us some predictions, based on a number of scenarios around the world, about possible changes in the Earth's climate between now and the year 2100. The magnitude of these potential changes and their consequences for human life are dramatic and frightening. They will affect nearly every detail of human existence, from the temperature and quality of our air and water to the number of potholes in our streets and the size of our electric bills.

I will not live to experience the long-term consequences of what is being discussed here today, but my daughter, Hana, who just had her first birthday, will. Our responsibility in this matter in the year 2100 is rooted not only in our duty as Senators, but in our obligations to our children and theirs.

Change is inevitable. The world I grew up in has changed dramatically. But the scope and speed of the changes that we will talk about today are unprecedented. They are not natural additions to the natural environment; they are man-made <u>alterations</u> of that environment which the environment cannot absorb and remain what it is. The actions we take from this time hence will make the difference between whether these changes are manageable or, indeed, survivable.

Our thinking in this country about the environment for the past two decades has been dominated by the concept that pollution could be controlled at reasonable cost and that environmental problems are local and readily correctable. The environment could be cleaned up, we thought, by passing tough laws regulating hazardous waste and strictly enforcing those laws.

That was not an unreasonable conclusion, given the state of our knowledge. But we now know that the problem of global warming will not be solved by simple regulation or law enforcement. We must be bold in our examination of solutions to the immense dilemma we face, and not be bound by the limitations of our experience to date. In many ways, we're going to have to change our way of life.

The economist, John Maynard Keynes, once said:

"In the field of economic and political philosophy there are not many who are influenced by new theories after they are 25 or 30 years of age, so that the ideas which civil servants and politicians and even agitators apply to current events are not likely to be the newest."

His caution has relevance to today's deliberation. The old way of doing business has gotten us into this fix. We need imagination and guts as we make our way across this uncharted territory. We should, therefore, examine the EPA report with an open mind and consider possible solutions without limit.

I compliment the staff at EPA for their effort to bring attention to this problem. I recognize that there are uncertainties in what they have written. But, to have waited until every uncertainty was resolved would waste time that is too precious. Every year we waste now could mean decades or even centuries of catastrophic effects for future generations.

I believe the EPA has acted with real vision and I believe that, by working together, we can take the necessary steps to limit the consequences of our past indifference to the world in which we live.

Senator BAUCUS. Senators Lautenberg and Warner have submitted statements which will be included in the record.

[The statements referred to follow:]

OPENING STATEMENT OF HON. FRANK R. LAUTENBERG, U.S. SENATOR FROM THE STATE OF NEW JERSEY

Mr. Chairman, I commend you for calling today's hearing to explore policies to prevent global warming and destruction of the ozone layer.

Last summer, the earth sent us a clear message: we are stressing our environment beyond its ability to cope. We had despoiled beaches, polluted marine waters, and record levels of air pollution. We saw more evidence of depletion of our stratospheric ozone layer. And we experienced record heat waves and severe droughts raising fears that we were witnessing the initial effects of the greenhouse effect.

This Subcommittee has had numerous hearings on the adverse effects that stratospheric ozone destruction and global warming will have on human health and our environment. Some argue that there are scientific uncertainties. But the message of last summer is clear: we're overtaxing our environment and we must adopt policies to restore the equilibrium of nature.

One policy we all agree on is to end the worldwide use of ozone destroying chemicals as rapidly as feasible. I'm pleased that Bill Reilly is working diligently to have these chemicals phased out by the year 2000 and that industry has made the commitment to find alternatives by that date. I am looking forward to Bill's report on the recent international conference regarding the phaseout of these chemicals.

Although there is less consensus on other policies to address global warming, it is equally clear that strong worldwide actions are needed now. U.S. action alone is not sufficient. We're responsible for only one-fifth of the worldwide emissions of gases contributing to the greenhouse effect.

But this must not be an excuse for inaction. The U.S. must be at the forefront of efforts to develop and implement policies to reduce emissions of greenhouse gases.

EPA's Draft Report To Congress on Policy Options For Stabilizing Global Climate demonstrates that we can take actions now to significantly reduce the potential impact of global warming. And by implementing some of the suggested policies, we also will reduce acid rain, urban ozone and dependence on imported energy.

The time to address global warming is now. I look forward to working with Bill Reilly and with you, Mr. Chairman, and the other members of this Committee, in achieving this goal.

I regret that I can't stay because of a Budget Committee markup. I have some questions that I would like Mr. Reilly to answer for the record.

OPENING STATEMENT OF HON. JOHN W. WARNER, U.S. SENATOR FROM THE COMMONWEALTH OF VIRGINIA

Mr. Chairman, I wish to commend you for calling this hearing today. This subcommittee has a full and ambitious agenda for the next three months with plans to consider toxics, non-attainment, and acid rain. But ozone depletion and global climate change are important concerns and it is not too early in this Congress to begin consideration of these issues.

I also wish to take the opportunity to once again welcome Administrator Reilly. I look forward to his comments this morning on the recent meetings in London on ozone depletion and on the recently completed EPA draft report regarding policy options for stabilizing global climate.

Recent scientific research clearly points to a correlation between human activities and increased concentration of "greenhouse gasses". The complex relationships between these gasses and ozone depletion and climate change are not fully understood and we must encourage continued efforts to fully understand this relationship. We must also continue to pursue efforts on both national and international efforts to address the problem.

There is no question that global warming presents a challenge to the scientific community. Forecasting the future of climactic conditions approaches educated guess work. As difficult as this task will be, however, I am inclined to believe that the scientific community will have the easier part of the task before us.

On a domestic and international level, we must develop methods to reduce the emissions of greenhouse gasses. This will not be easy. Energy consumers, industries, agricultural activities and deforestation all contribute to the emission of greenhouse gasses. Global warming will affect different parts of the globe in different ways. Ad-

dressing the problem will have a cost—a cost that must be allocated nationally and internationally.

There will not be easy choices, but they are decisions that will have to be made. We all share the same planet. I am encouraged by recent progress that has been made to strengthen the Montreal protocol on substances that deplete the ozone layer. I look forward to hearing a report on the recent meeting in London and the prospects for the upcoming meeting in Helsinki.

Mr. Chairman, ozone depletion and global warming are problems that must be addressed. I look forward to working with you and my other colleagues in the Senate as we continue to seek solutions.

Senator BAUCUS. Thank you.

Senator Humphrey?

Senator HUMPHREY. No statement, Mr. Chairman, thank you.

Senator BAUCUS. Mr. Reilly, before you begin, I would just like to recognize Linda Fisher and Dick Morgenstern, who did an excellent job on this report. You could not fully analyze and document every point and every assertion of course, but nevertheless, given the time constraints and the massive, mammoth undertaking that you were charged with, I do want to compliment you for doing this job.

This report was requested by the Congress—I think it was Senator Chafee who offered an amendment to the Appropriations Bill, which Senator Durenberger and I cosponsored—asking EPA to do this study. I would like you now to comment on it.

STATEMENT OF HON. WILLIAM K. REILLY, ADMINISTRATOR, ENVIRONMENTAL PROTECTION AGENCY, ACCOMPANIED BY LINDA FISHER, ASSISTANT ADMINISTRATOR FOR POLICY, PLANNING, AND EVALUATION, AND RICHARD D. MORGENSTERN, DIRECTOR, OFFICE OF POLICY ANALYSIS

Mr. REILLY. Thank you, Mr. Chairman and Members of the Committee. I compliment you, sir, and the committee on the initiative and interest that the committee has shown and the real leadership that has led to the development of this report. The committee has played a critical role in developing the basis for our undertaking of this effort and in moving the country ahead in looking at some of these questions in a way that, to my knowledge, no other nation has yet done.

A couple of weeks ago, I led the U.S. delegation to the conference that Prime Minister Thatcher called in London on the protection of the stratospheric ozone layer. As I listened to the rather alarming science that was presented, I had two reactions—I suppose a bad news and a good news reaction, Senator Lieberman.

The first was to wonder how much else may be occurring in the planet that potentially has serious, even calamitous effects, that we may not be aware of. Also, whether we have as a world community, the intellectual, financial, and institutional resources to recognize those problems in time and to manage them. The second strong impression that I had was of pride that the United States is playing a leadership role on some of these questions, and that as we do so and as I joined the other 120 or so delegations present at that conference, I had a very strong sense that the rest of the world welcomes this initiative, welcomes this leadership, and I am very certain, will make very effective, interested use of this report.

I ask that my prepared statement be included in the record, and I will proceed to use a series of charts and talk both about the stratospheric ozone issue and also about the stabilization report in global warming.

Senator BAUCUS. Without objection, your statement will be included in the record.

Mr. REILLY. Thank you, Mr. Chairman.

These issues share a great deal in common. They are global in scope and they involve complex atmospheric issues. They have potentially broad environmental consequences, and they require an international response.

Let me turn first to the Montreal Protocol and the stratospheric ozone issue. This committee followed very closely the international negotiations that led to the Montreal Protocol and, throughout this process, actively supported our efforts, by introducing a resolution in favor of a strong Protocol, for example.

CHART 1

US Environmental Protection Agency

STATUS OF MONTREAL PROTOCOL

- **Signed in September 1987**
- **Entered into Force on January 1, 1989**
- **50% Reduction in CFCs by 1998**
- **Contains Assessments and Review Process**

Mr. REILLY. These efforts did produce an historic international environmental agreement in September 1987. Enough nations did ratify it for it to go into effect on January 1, 1989. It had been ratified by more than 11 nations representing more than two-thirds global CFC consumption at that time.

Based on the scientific information that was available in September of 1987, the Protocol called for a 50 percent cut in CFCs, phased in over the next 10 years and a freeze at the 1986 level of halons, beginning in 1992. We recognize that significant scientific issues were outstanding.

At the time, we knew that an Antarctic ozone hole existed, but we were not certain whether it was due to CFCs or to other possibly natural forces. As a result, a key provision in the Protocol called for periodic assessments of scientific, technological, environmental, and economic information, which could serve as a basis for changing the control requirements if that appeared warranted.

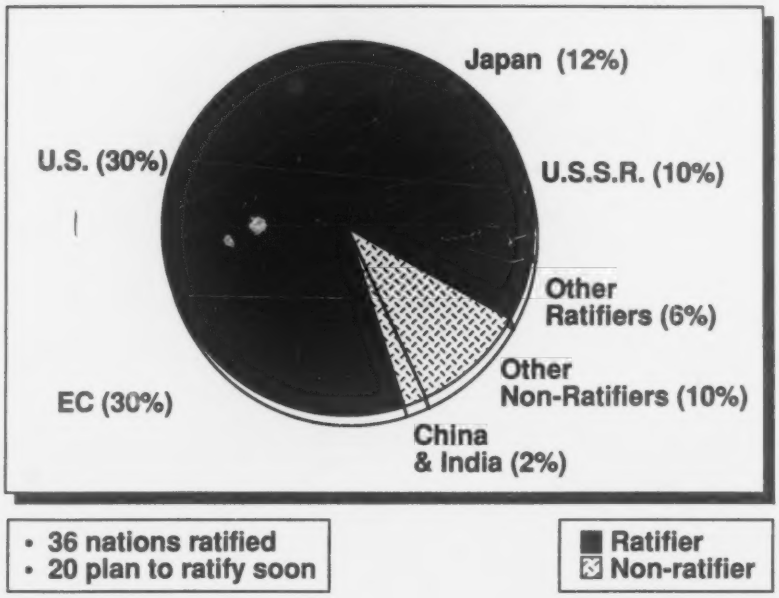
The Protocol has been widely supported, both at home by industry and by the environmental community, and also abroad. Thirty-six nations have now ratified the agreement, and that is remarka-

ble, given the very short time that has elapsed since it was signed and the history of longer ratification efforts with respect to other international agreements. Incidentally, an additional 20 nations agreed and announced their agreement to the Prime Minister of Great Britain in London that they intended to ratify, and an additional 10 were going to take home recommendations to that effect.

CHART 2

U.S. Environmental Protection Agency

International Participation in Montreal Protocol
(Percentage of 1986 CFC Use)



Mr. REILLY. It was attended by more than 120 nations. There were 80 or so represented by ministers. This high level phase-out was echoed by the European participation. Probably the most, I think, since the UN Conference on the Human Environment in Stockholm in 1972, which of course, had so much to do with launching the international environment as a significant issue.

Just prior to our leaving for this conference, President Bush demonstrated his commitment to safeguarding our global environment by announcing our government's support for changing the Protocol to require a phase-out of CFCs and halons by the turn of the century. At the London meeting, the call for a phase-out was also made by the European community, the Nordic countries, Canada, and others. This degree of support should provide a very strong basis for successfully strengthening the Protocol by revisiting the goal that it had set.

A tentative schedule has been developed by the United Nations Environment Program for accomplishing these necessary changes. In response to the urging by my predecessor, Lee Thomas, and let-

ters from yourselves to UNEP, the assessment and review process has been expedited.

Implementation of the Protocol officially began this past January. The first meeting of the parties is scheduled for May, and the assessments are scheduled to be in by August of this year.

CHART 3

US Environmental Protection Agency

NEXT STEPS IMPLEMENTING PROTOCOL

- **First Meeting of Parties** **May 1989**
- **Completion of Assessments** **August 1989**
- **Recommendations on Changes** **September 1989**
- **Parties Act on Changes** **April 1990**

CHART 4

US Environmental Protection Agency

CHALLENGES AHEAD

- **Encourage Greater LDC Participation**
- **Ensure Safe, Energy Efficient Substitutes**
- **Renegotiate Terms of Protocol**

Mr. REILLY. These should serve as the basis for recommendations by the parties of changes to the agreement which are scheduled to be developed in September of this year. A meeting of the parties is scheduled for April, 1990, to decide on changes. The Protocol requires that the parties be given six months before voting on the recommendations.

I am optimistic that we are on track in making some of the necessary changes to the Protocol, but I also have to say that I think the future is going to present some difficult challenges. First, it became very clear during the London meeting, that we are going to have to make every effort to follow up on the technology transfer provisions of the Protocol to facilitate the participation of the de-

veloping countries. Along these lines, we are very encouraged that the President of the World Bank has already expressed the Bank's interest in working on this issue with the LDCs in helping them make the transition away from CFCs.

The second challenge involves ensuring that the CFC substitutes are safe and efficient. Industry has initiated a voluntary cooperative toxicology testing program for the most likely substitutes, which should mean that these are the most heavily tested chemicals ever introduced commercially.

We intend to use our authority under the Toxic Substances Control Act to ensure that test results are properly reviewed, and we intent to take whatever additional steps that may be necessary to ensure the safety of the CFC substitutes. We are also working closely with the CFC industries to encourage the development and selection of substitutes which will increase, rather than sacrifice, energy efficiency.

Finally, while support for a phase-out is building, there are other difficult issues that we have got to resolve in the upcoming Protocol negotiations. We need to decide on the timing of interim reductions in CFCs and halons. We need to decide on whether chlorinated compounds that are not now covered by the Protocol, like carbon tetrachloride and methyl chloroform, should be restricted.

We also need to decide whether some of the CFC substitutes, which may also contribute some small quantities of chlorine to the atmosphere, but are essential to an early phase-out of CFCs, should also be controlled. We look forward to working with this committee as we move forward to resolve these issues and to consulting closely with you in the months ahead on the very rapidly evolving science, assessments, and preparatory work for revisiting the Protocol.

I will turn now to EPA's draft study on greenhouse gasses. In 1986, several members of this committee sent then Administrator Thomas a letter asking EPA what policy actions would be necessary to stabilize greenhouse gas concentrations. After careful thought, the Agency established the following set of goals to respond to your request.

EPA researched the current trends in concentration of greenhouse gasses and developed a global inventory of emission sources. We then projected what might happen to future emissions based on alternative assumptions concerning rates of economic growth.

Our charge was to then identify emission-limiting policies and technologies and to assess what difference they might make for global warming. Throughout this process, the Agency consulted a wide range of experts and held a series of public workshops on technological and economic trends.

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CHART 5

US Environmental Protection Agency

GOALS FOR THE STABILIZATION REPORT

- **Define the Nature of the Problem and its Causes**
- **Assess Future Trends in Global Emissions**
- **Identify Emission-Limiting Policies and Technologies**

Chart 6

US Environmental Protection Agency

LIMITATIONS

- **Economic Growth and Technological Change are Difficult to Predict**
- **Detailed Cost Analyses of Policies Were Not Conducted**
- **Models of the Global Economy, Oceans and Climate are Highly Simplified**

Mr. REILLY. While I believe that we responded fully to your request, I would be remiss if I did not point out the limitations associated with any analysis of this type. Given the nature of the problem and the time frame of concern, warming during the next century, assessments of economic growth, and technological change are extremely uncertain. While we have identified options for reducing emissions, we have not conducted detailed cost analyses, and in most cases, there is much additional work that is going to be necessary before we could proceed on the basis of this work to develop policy recommendations.

Finally, our simulation of both the global economic and the global climate systems is highly simplified. We have attempted to make the best use of current knowledge, but that knowledge is limited.

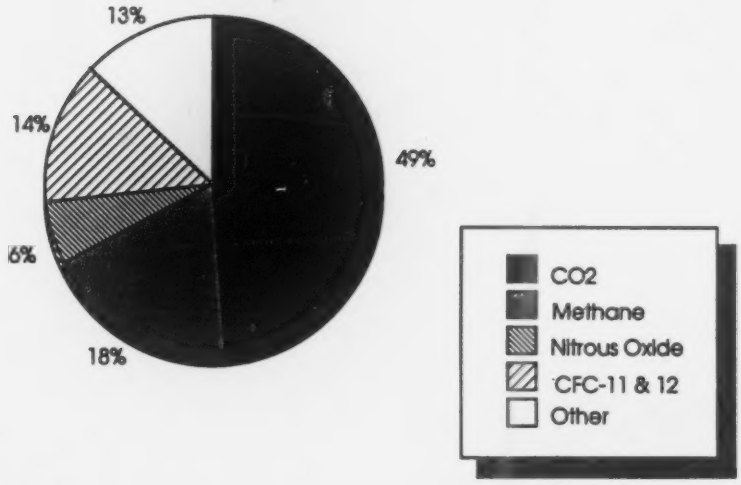
Before I get into the details of the report, let me say something about the nature of the greenhouse gas problem itself. There are,

as you know, several greenhouse gasses of concern. The gas with the largest contribution is CO_2, accounting for about half of the problem. Sources of CO_2 are fossil fuel combustion, about 85 percent, and deforestation, about 15 percent.

US Environmental Protection Agency

Chart 7

Greenhouse Gas Contributions to Global Warming



Source: Hansen et al.

Mr. REILLY. Other gasses include methane, which comes from rice fields, cows, landfills, energy production, and other sources, and which constitutes about 18 percent of the problem. Nitrous oxides come from fertilizer use, combustion, and many natural sources. They constitute about six percent of the problem. I have already spoken about CFCs in the context of ozone depletion. They are somewhere in the range of 15 to 18 percent of the problem.

While this chart conveys which are the important greenhouse gasses, it does not show how the causes of the problem are changing. There are some very interesting trends in this regard.

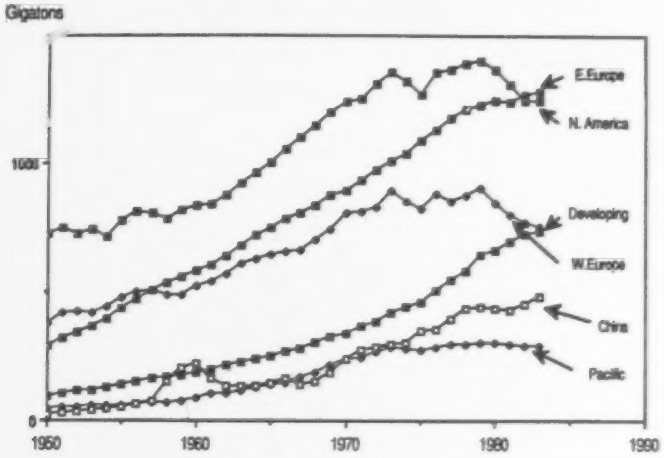
The chart shows that while fossil fuel CO_2 emissions in both the United States and the OECD countries have increased in the past, they are now relatively constant. This is due to dramatic energy efficiency improvements since the early 1970s.

For example, in the U.S., energy efficiency has increased 40 percent over this time period. The trend is very different in some other parts of the world. In China and the other developing countries and in Eastern Europe, emissions continued to increase over the entire period.

US Environmental Protection Agency

Chart 8

Annual Fossil Fuel CO2 Emissions by World Region 1950-1985



Source: R.Roty, 1987

US Environmental Protection Agency

Chart 9

MAJOR FINDINGS

- **Uncertainties are Large, but Rapid Climatic Change Over the Next Century is Possible.**
- **Policy and Technologies Can Make a Difference.**
- **Effective Action Involves the Cooperation of Many Countries.**
- **A Wide Menu of Policies and Technologies is Available.**

Mr. REILLY. With this background, let me now turn to the results of EPA's report. Having assembled and analyzed the data concerning physical processes and having consulted with the experts concerning economic and technological trends, our report found that there is indeed serious cause for concern.

If we continue business as usual, rapid climatic change is likely or possible over the next century. However, our report did find that policies and technological choices can make a difference in slowing the rate of warming.

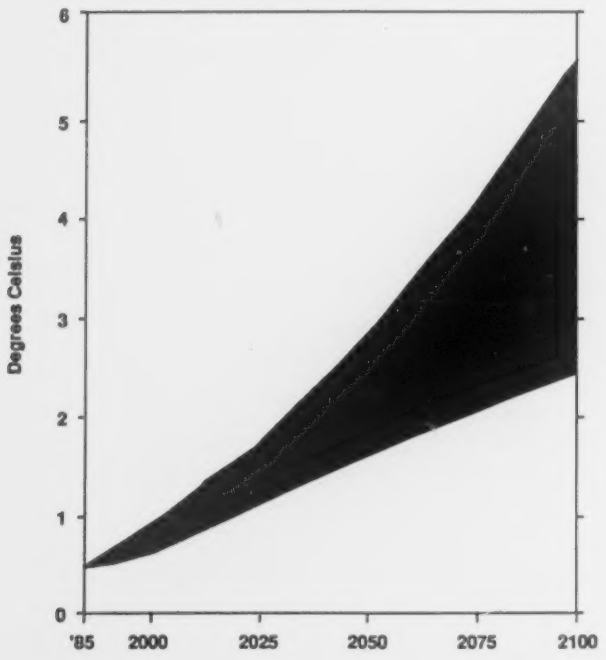
If action is to be effective, however, it must involve the cooperation of many countries. This is truly a global problem.

Just as there are many countries and activities contributing to the problem, there is also a wide range of policy and technological choices for limiting emissions. There is no single right response to this problem. Let me elaborate on each of these conclusions.

While there are large uncertainties concerning future economic activity and the likely response of the climate system to greenhouse gas buildup, rapid climatic change is possible. The graph shows the amount of warming projected for the next century. Uncertainty is represented by the shaded area and is due to alternative assumptions about world economic growth rates and the physical response of the climate system to greenhouse gas concentrations.

Chart 10

U.S. Environmental Protection Agency



Uncertainties are large, but rapid climatic change over the next century is possible.

Realized Warming: No Response Scenarios
(2 - 4 Degree Climate Sensitivity)

Mr. REILLY. The lower end of the range assumes economic growth of a relatively slow type and incorporates assumptions that tend to minimize the impact of greenhouse gas concentrations on climate. The upper end does the converse of that, assumes a more rapidly growing world, economically.

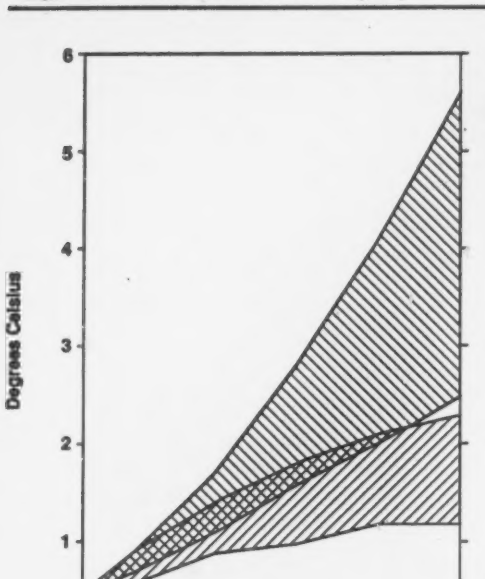
Our analysis estimates warming of 2.5 to 5.5 degrees Celsius by the year 2100. To put this in perspective, the difference in the annual average temperature between Boston and Washington is 3.3 degrees Celsius.

However, policies and technologies can make a difference. Although our study did not consider costs, it did identify a number of technological and policy options that, if implemented on a global

scale, would reduce the rate of warming. These could limit global warming to roughly one to two degrees Celsius by the year 2100.

Chart 11

U.S. Environmental Protection Agency



Policies and technologies to limit greenhouse gas emissions could decrease the magnitude and speed of global warming.

Realized Warming: No Response and Stabilizing Policy Scenarios
(2 - 4 Degree Climate Sensitivity)

Mr. REILLY. I say on a global scale because our report underscores the need for global cooperation on this issue. It is an issue just like the stratospheric ozone issue, in which every country is hostage to the policies and activities of every other.

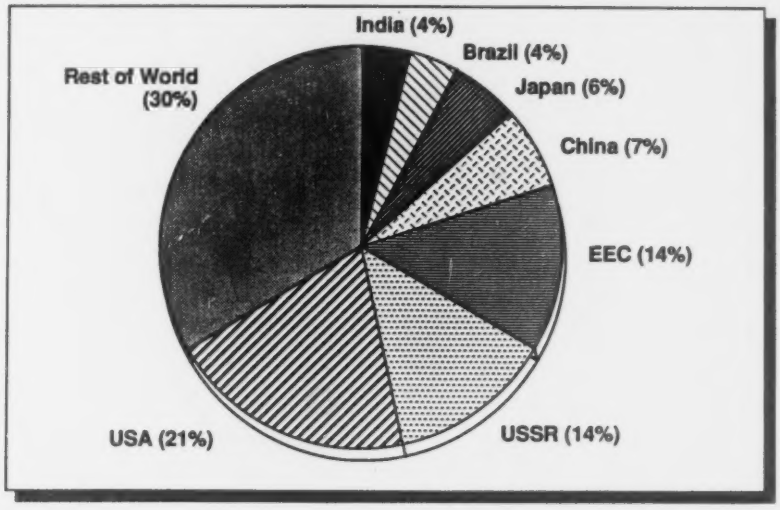
No single country dominates in the emission of greenhouse gasses. All contribute. Virtually all must cooperate if we are to effectively deal with these problems.

The U.S. is still the largest single contributor, but it still accounts for only about one-fifth of the problem. The European community nations plus Japan account for another fifth. The Soviet Union accounts for 14 percent, and when combined with other Eastern Bloc nations, which are not broken down separately on the chart, that adds up to another fifth.

U.S. Environmental Protection Agency

Chart 12

Effective Action Involves the Cooperation of Many Countries



SOURCES: EPA (1988), Tirpak (1986), United Nations (1987), US Bureau of Mines (1985), IRRI (1988), FAO (1987,1986), Bolle, et al. (1986), Rotty (1987), Lerner, et al. (1987), Seiler (1984), WMO (1985)

Mr. REILLY. As to what can be done about the problem, there is a wide range of options available for reducing emissions. These are discussed in detail in the report so I will just highlight them here. We talked about the importance of finding substitutes for CFCs, and I would emphasize that this is beneficial, not just for addressing ozone depletion, but also for dealing with global warming.

In addition, there are a number of options for improving energy efficiency that deserve increased attention. These range from insulating materials to vehicle efficiency. Alternative fuels, including natural gas, are also a promising means for reducing greenhouse gas emissions. Research regarding agricultural practices to limit methane emissions from animals and rice may result in an important means for reducing greenhouse gas emissions.

Finally, stopping deforestation and increasing reforestation is an obvious policy option, not only for reducing global warming, but because preservation of these unique ecosystems is in and of itself a very worthy goal.

This is a first step in producing a policy response to this issue. We are proud of it. In the short term, we will be looking to obtain feedback on our report from the Scientific Advisory Board at EPA, and once this is done, to consulting formally with other agencies in the government, and then to forwarding it to you, formally.

US Environmental Protection Agency

Chart 13

A WIDE MENU OF POLICIES AND TECHNOLOGIES IS AVAILABLE

- CFC SUBSTITUTES
- ENERGY EFFICIENCY
  - Lighting
  - Vehicles
  - Industrial processes
  - Insulating materials
- ALTERNATIVE FUELS
  - Biomass
  - Nuclear
  - Energy Storage
  - Solar
  - Hydrogen
  - Natural Gas
- AGRICULTURAL PRACTICES
  - Animals
  - Biomass Burning
  - Rice Production
- REFORESTATION AND DEFORESTATION

US Environmental Protection Agency

Chart 14

EPA'S STUDY IS A FIRST STEP...

ADDITIONAL WORK REMAINS TO BE DONE

- Obtain Feedback on Our Report from SAB and Others
- Assess Technologies/Costs and Investment Strategies
- Analyze Domestic and International Implementation Options (Market/Regulatory/Political/Cultural Barriers)
- Conduct Research on Oceans, Clouds, Biological, and Climate Feedbacks
- Utilize Intergovernmental Panel on Climate Change (IPCC) to Develop International Understanding
- Develop National Policy as Required by the Climate Protection Act

Mr. REILLY. In the meantime, we will pick up where the current report leaves off and continue our assessment of the costs and benefits of alternative technological and policy strategies. We will extend this work to look at how we might be able to implement various kinds of policy responses and strategies given political and cultural barriers.

We will continue to participate in the Federal research process to improve our understanding of oceans, clouds, and biological feedback, and their role in the climate system. We will move forward through the intergovernmental program on climate change to improve the international understanding on this issue, and then develop a consensus on an appropriate international policy response.

Let me point out that the United States is chairing a working group on response strategies under the IPCC. I believe that this is a good forum for moving forward internationally on this issue. Finally, EPA intends to fulfill its mandate under the Global Climate Protection Act to develop a national policy for global climate change.

That concludes my remarks, Mr. Chairman. I would be pleased to answer any questions you may have. As you mentioned, I am accompanied here today by the Assistant Administrator for Policy, Planning and Evaluation, Linda Fisher, and by the Director of the Office of Policy Analysis, Dr. Morgenstern.

Senator BAUCUS. Thank you very much, Mr. Reilly.

I believe this report to be very significant because, as I understand it and as I see it, this is the first time that a major, credible body—the Environmental Protection Agency—has issued a report around which there is a consensus that if greenhouse gasses are left unchecked, there will be a very dramatic and adverse effect on the climatic change around the world. That is very significant.

There is some dispute as to the degree to which that will occur. There is some dispute as to how quickly these changes will occur. There is considerable question as to interactions of all the various effects, such as the degree to which the ocean soaks up carbon dioxide and how quickly. However, there is a consensus that the greenhouse phenomenon is very real and could have a very adverse effect on the world unless something is done about it.

The fact that struck me more than any other in this report is that, if left unchecked with nothing done worldwide, the greenhouse gasses will double by the year 2040. I further understand from the report, assuming a rapid technological change in the world's development could result in an increase of 5.5 degrees Celsius. If that is the case, to put that in perspective, I understand that would be a greater climatic change in global warming over the next 45 years than has occurred in the last 18,000 years since the Ice Age.

I want to first ask you if I am correct in saying that this report is the first major report where there is a consensus that we have a problem and we have to do something about it. Then more specifically, I would like you to respond to the fact I mentioned, the possible five degree Celsius increase in temperature by roughly the year 2040, assuming no further changes and that, that climatic change over the next 50 or 60 years is greater than the last 18,000 years since the Ice Age.

Mr. REILLY. Mr. Chairman, I think that I should not say that this is the first report that draws those conclusions. This report is concerned with looking at the potential policy options that might address the problem if it is as serious as it appears to be in other research.

The basis for the scientific assumptions that we make in the report has really been laid by the National Academy of Science, and it is as you stated and as it appears in the report. There is a very significant reason for concern that a warming of 2.5 to 5.5 degrees Celsius could occur by the year 2100.

I think the contribution of this report is to suggest that with a variety of in many cases ambitious policy responses, we could limit global warming, not stabilize it. This report did not really find a way to do that, even with these very ambitious policies that are presented here to limit global warming to roughly one to two degrees Celsius by the year 2100.

Senator BAUCUS. I was further struck by just how widespread this problem is and that there is not one solution. The United States accounts for about 20 percent of the problem, we are probably the largest single country that contributes to greenhouse gasses, but we contribute only 20 percent. The other 80 percent is caused by other countries.

Secondly, even though fossil fuel combustion is a major source of greenhouse gas emissions, there are many others, also. That means that there is no magic wand and no silver bullet that is going to solve all of this. It will take a constant effort in many different areas among most of the countries of the world to solve this problem.

For example, a major part of the solution is CFC phaseouts. As you mentioned, CFCs account for about 15 to 18 percent of greenhouse gasses. Certainly, reforestation is part of the solution. Improved transportation efficiency is a major part of the solution, too. If automobiles get an average of 40 to 50 miles per gallon with better emission controls, that will be part of the solution.

Perhaps we should even be going further, such as fees on greenhouse gas production or consumption as a way to reflect the true costs to the environment of some of those activities. I just am wondering if you could comment again on the complexity of the solution and the wide range of alternatives that we have to undertake if we are going to solve this?

Mr. REILLY. I think you have stated it very well, Mr. Chairman. I would say two things about it. First of all, the response to this problem can not be a unilateral one. I think we have to work very closely with the world community to try to ensure that the kinds of policy choices we make are not cancelled out by decisions on energy use or in other areas by other countries.

That is true with respect to ozone depletion. There is a great deal of concern on the part of some countries, who have ratified the Montreal Protocol, lest some of the developing countries that have not begin to move into production and use of CFCs and more than offset any of the gains that are made.

The Director of the International Union for the Conservation of Nature, Martin Holgate, happened to mention this week that something like half of the members of the British Commonwealth are

island nations or are situated in such a way that a sea level rise of a meter or so would cause havoc to their societies. The kinds of changes that are possible in the global warming area do give everybody an incentive to look for these solutions, but when you realize that we are going to have to look at fundamental changes in the technologies of transportation, in the way that agriculture is managed, both with respect to cattle and rice cultivation, particularly in Asia, we may need something on the order of a new breakthrough as significant as the Green Revolution in plants and rice that do not generate the very heavy output of methane, which as you saw, is a fairly large contributor of that.

These are all going to have to be explored. We are obviously going to have to bring along much of the world to understand the science and to support further research into a whole variety of questions about likely climatic responses as global warming begins.

There is not a complete consensus about some of those issues, but that is the job ahead of us. It is a very big one, as you suggest.

Senator BAUCUS. You touch on an excellent point—that is, the importance of American leadership as well as Presidential leadership. If there is any lesson to be learned in the attempts to pass Clean Air Act legislation, it is the importance of the support of the President.

Last year, we did not have Presidential support here in the Congress when we attempted to pass Clean Air legislation, and I think that is largely the reason why Congress did not pass Clean Air legislation. This year, we do have the support of the President. It is very welcome support and I applaud the President for that support.

It is clear to me that it is important to have that support and Presidential leadership. And certainly, if we expect the world to act, it is important to have American leadership. I ask you as Administrator of EPA, the degree to which the President will lead on this issue. It is important to have Presidential leadership in working with the Congress. Secondly, I ask you the degree to which it is the intention of the United States to lead by first enacting remedial solutions so that we can encourage other countries to follow along?

Mr. REILLY. I would first say, Mr. Chairman, that I think you are absolutely right—in order for the United States to be in a position of world leadership, we have to lead by example. Clearly, we have to do better than we have done in any number of areas of the policy affecting our environmental protection and energy use. As we do that, I believe that the world will look to us for leadership.

The President has made very clear that he intends to see us take a leadership role both at home and abroad on issues of the environment. He has committed, as you know, to a major comprehensive legislative proposal to re-authorize the Clean Air Act, which we hope to present here in May.

He had his Secretary of State make his first formal speech at the International Panel on Climate Change, something that received a very warm welcome in that community. I believe it is notable for what it says about the intention of the Secretary of State and certainly of the President to make sure that our foreign policy is sensitive to the environment.

He sent me to London with a very strong commitment by the United States to work through the Protocol to phase out CFCs by the end of the century. In a note that he gave me for Prime Minister Thatcher, he reiterated his support for what she is doing and for that conference.

Senator BAUCUS. Thank you very much, Mr. Reilly. I applaud those efforts.

Mr. REILLY. Thank you, sir.

Senator BAUCUS. Senator Chafee.

Senator CHAFEE. Thank you, Mr. Chairman.

It seems to me that we have two different problems here that are intertwined to some degree, but are still separate problems. One is the CFC problem, the ozone, and the other is the global warming problem.

The point I would like to make is that your charts show CFCs contribute about 14 percent to the global warming, and I have heard others say that it might be 20 percent. Obviously, it is hard to pin down how much it is.

The point is that by dealing with the CFCs, you are getting to 14 to 20 percent of the global warming, which is a great big chunk. Thus it seems to me that it behooves us to move ahead with all the speed we can on the CFC problem because it really is two problems.

Therefore, I am asking the following questions. In studying what the Europeans said about the 100 percent cessation of the CFCs by the end of the century—did they say that they were going to mandate that, or did they say that this was going to be a voluntary effort by industry?

Mr. REILLY. There is a little bit of confusion about exactly what the European community intends. I think that it may reflect a difference of intention on the part of some of the member governments.

The European use of CFCs presently consists of about 40 percent for aerosols, which as you know, have been banned in the United States for almost all uses for the past 10 years or so. So, they can get, by a simple aerosol ban, a significant way toward their goal within a year so.

I believe that they will work through the Montreal Protocol as a community, however, and the processes that it has set to achieve the goals that we want. I know from conversation that some of them are as concerned as we in the United States are about bringing along that large remaining number of countries that have not ratified and that do have the capacity to produce and consume significant amounts of CFCs over the period.

Senator CHAFEE. What I urge is that we move full speed, pressing them on the efforts in CFCs. I and some others have introduced legislation that would end CFCs earlier. Mine is a 100 percent phase-out by 1997. Plus, it seems to be just as important, to mandate the recapture of these CFCs prior to that. We do not have to wait for the 100 percent phase-out before we recapture them from the refrigerators, air conditioners, or whatever is thrown away.

The President has endorsed the 100 percent phase-out for the year 2000, but it was a little fuzzy in that he said, "Contingent upon the finding of safe substitutes." Now I would hope that we

would not get into waiting for the safe substitutes because then there is no pressure at all for the production of safe substitutes.

I do not understand why the caveat is there. Why doesn't the President just say, "Out, by the year 2000?" That would force the ingenuity and brains of the Nation to come up with safe substitutes.

By the way, the world got along without CFCs for eons before they came along. It is not like oxygen—we don't need them to survive.

Mr. REILLY. Senator, I think that the President was expressing a couple of concerns with his statement. One, that we undertake efforts on an accelerated basis, but that we do not do that unilaterally. We do it as part of this Protocol, which itself should stand for the capacity of the world to resolve any number of problems that are going to come along and require multilateral action.

We want to see the Protocol succeed—it makes sense to work through it. We certainly do not want to act as though it does not exist. The Protocol itself established these processes for assessing the technology and the substitutes as time passed, and we are very reassured by conversations with industry that we are going to have substitutes over this time period.

I think we are likely to have substitutes for any number of significant uses. The automotive manufacturers are expecting to introduce substitutes in the 1994 model cars for their refrigerants, the coolants in the air conditioners. As you suggest, recapture and recycling can make a very significant contribution to CFC reduction.

Finally, I think that there may be some very few remaining uses that we will have more difficulty replacing. That qualification is intended to address that which we are not quite aware of now. I should not underestimate though the job of coming up with these substitutes, making sure that they do not exacerbate the problem, that they are not ozone depleting as well, making sure that they are not toxic, and making sure that whatever advantage you get from their not depleting the ozone is not offset by a compensating disadvantage by leading to greater inefficiency in energy use, which would then contribute to global warming.

There are all those questions to be weighed in the balance. It is not by any means and easy or short-term problem, but the President is committed to moving just as fast as we can as a society, and I think that the industry believes that we can probably make very significant gains toward that full phase-out goal relatively early in the decade.

Senator CHAFEE. Thank you, Mr. Chairman.

Senator BAUCUS. Thank you, Senator Chafee.

Senator Lieberman.

Senator LIEBERMAN. Thank you, Mr. Chairman.

Again, Mr. Reilly, thank you for your testimony, which makes me feel that we have an EPA Administrator who sees the problem and is out there trying to help us do something about it. I thank you for that.

Let me first ask whether or not you agree with my bad news/good news assessment of the report, which is that there is a problem, there are things we can do to avoid the worst consequences of

it, and that delay has an effect. In other words, the sooner we act, the more we can reduce the problem.

Mr. REILLY. I think that is quite fair, yes sir.

Senator LIEBERMAN. What is clear from some of the suggestions that are in the report and that you have mentioned today is that there is a need in the solution part of this, the good news part, for some dramatic actions including changes in the way we live and do business. They involve not only inconvenience, which is a factor, but also money, as so much else does.

It strikes me as I hear this dialogue that we will also be dramatically inconvenienced and have to pay a lot of money if we do nothing. I have a copy of a report that was issued by EPA before you came on board, from October of last year, about the potential effects of global climate change, and there is a sentence in here that says, "Managed systems may be able to adapt, although the costs of adjusting may be hundreds of billions of dollars."

I think what they are talking about here is—this is if we do not do anything in adjusting the climate change— protecting developed coastlines, building more powerplants for more air conditioning, building and adjusting water resource infrastructure, dredging ports and harbors because of increases in the water level. I do not see it there, but I presume the need that we might have to move agriculture from where it is to where it would be more climatically suited if this change occurred—all of this will cost money.

My request is whether it is possible, as you play a critical role in the national and international dialogue, for EPA to try to come up with some economic quantifications here of how much we are all going to be put out and how much it will cost us if we just sit back and let the globe warm, as this report suggests will happen?

Mr. REILLY. I think your basic premise is quite correct, that those who react with horror to some of the very significant changes that we are recognizing as likely to be necessary in technology, energy use, transportation, and the rest, need to put into the balance the fact that these problems themselves, if they are as serious as appears, are going to be disruptive to all sorts of things. The economics of that—some of that has been done and looked at in previous work at EPA and a good deal more is planned.

We have in our own research agenda some plans to go further and to try to look both at economic aspects of the dislocation and also at some of the economic implications of the proposals that are made in the stabilization report, which we did not do here. That is in the plan though.

Senator LIEBERMAN. That is very reassuring and that will be very helpful.

One of the other things that becomes clear as you go over the potential responses that government might get into to avoid the worst consequences is that these are all things that have good value to them besides helping us avoid the warming of the planet, alternative energy and the rest. In that regard, I looked back at some budgets of the Department of Energy in research and development funding for renewable energy—$708 million, not an enormous amount, but significant in 1981—down to $118 million in 1988.

Earlier this month, March 7th, the New York Times ran an article describing a loss of interest in solar energy by U.S. companies, stating that, "They are losing interest just as the technology to transform sunlight into electricity is getting closer to being economically competitive with conventional power sources." The article actually goes on to state that this growing field may become one that will be dominated by other countries, such as the Japanese.

My question here, as part of this advocacy role that we hope you will play, is whether or not there is something that you can do—I understand that DOE has the primary responsibility for research funds—in your relationship with DOE? Also, perhaps with the private sector, to suggest that this is not only good for the planet, but it is also good for the economy?

Mr. REILLY. That is an excellent point, Senator. There are so many reasons that this country should work to try to improve its energy efficiency: to try to stretch out energy supplies, to try to reduce the pollution consequences of fossil fuel use, to try to encourage and foster reforestation abroad and to discourage deforestation through our foreign aid policy and our influence on multilateral aid and lending institutions. All of those make tremendous sense, as it does to look at the ways to encourage use of some of these alternative fuels which are more benign.

Energy prices change, of course. The energy price declines for conventional fuels in the early 1980s dealt a very severe blow to much of the hope that solar would come on early, though we do make some assumptions in the report that solar is already economically feasible in a number of remote locations for certain kinds of uses, and that by the end of the century, we will see significantly more solar use.

Senator LIEBERMAN. Thank you.

Thank you, Mr. Chairman.

Senator BAUCUS. Mr. Reilly, I would like to follow up on a point made in the report on page 89 under number IV. The main heading is: A wide range of policy choices is available to reduce greenhouse gas emissions while promoting economic development, environmental, and social goals." You then have a second bullet down there that says essentially: If limiting the greenhouse gas buildup is desired, government action will be necessary. Market prices of energy from fossil fuels, products made with CFCs, forests and agricultural products, and other commodities responsible for greenhouse gas emissions, do not reflect the risks of climate change. That is, market prices do not reflect the risks of climate change.

Would you elaborate on that a little for us, and maybe tell us what you think that implies and what you think the consequences of that would be in terms of public policy?

Mr. REILLY. I think this is a problem that has affected us in many areas of environmental protection. When you have pollution, that obviously makes sense in terms of economic choices, but does not reflect the large costs that it imposes.

We try to internalize those costs through a variety of means. One of the most obvious and traditional in this society has been regulation.

We are proposing, as you may know, the auctioning off or assessing of fees against chlorofluorocarbon manufacturing rights. In fact, we have proposed a level of about $400 million in revenues that are anticipated in the budget that has just been submitted.

Senator BAUCUS. I have a bill that does just that, too.

Mr. REILLY. Yes, sir, you do.

That is, I think, possibly the best example of a way in which we try to recapture a windfall that is associated with reducing the supply of CFCs. It may be that down the road we will want to look at other such possibilities.

Senator BAUCUS. That brings me to another point.

Senator Chafee made an excellent point about urging the Administration to go forward, not being too cautious in developing proposals for the development of new technologies. The Chinese character for crisis is really two characters. One is the character of danger and the other is the character of opportunity.

Certainly, the crisis of global warming very clearly shouts out the dangers, climatic change, crop losses, New Orleans being flooded, islands being flooded—there are all kinds of serious dangers to the consequences. But I think that it is also important to look at the opportunities here.

One of those opportunities is in developing new technologies. I think it is important to remember that the Clean Air Act was passed back in the seventies. Congress mandated new technologies that did not then even exist. Congress did not then go into the question of whether or not the existing technologies are cost efficient. Congress mandated new technologies that were non-existent and told the industry to go out and develop these technologies. Do you know what? They did develop new technologies to help make the air a little cleaner.

We will probably have to go even further if we are going to continue, in the Clear Air Act Amendments, to help reduce lower atmospheric ozone depletion, nitrous oxides, hydrocarbons, and so forth. I do think it is important to remember that sometimes we have to mandate certain things before they happen. Otherwise, there is delay after delay, rationalize and rationalize.

The second point here is this. The United States has lost its lead in the development of environmental technologies. Other countries are now taking the lead in the development and production of environmental technologies.

If we are going to reduce our trade deficit, it seems to me that we should take advantage of the opportunity here in developing technologies at home in our own country so that we can sell technologies overseas, particularly if other countries are going to have to implement new technologies in order to join with America in solving this problem. The developing countries are going to have a hard time developing these technologies for themselves.

If the United States develops technologies, then we could somehow work out some arrangement—not selling them directly—with other countries so that they would have the technologies developed and produced in this country. It just seems to me that, that is one opportunity that we have in this country. I encourage the Administration to look at the positive side of how to develop the technologies that we Americans can take care of.

Mr. REILLY. Mr. Chairman, I think you stated that very well. I think that is precisely correct.

I want to do two things. I think we want to ensure that as a matter of public policy we are not doing anything in the environmental area or anywhere else that is going to impede the introduction of new technologies or get in the way of some of the reforms that we hope to encourage.

Secondly, we need to do everything we can to encourage industry to think just that way. I think that with respect to CFCs, it has in fact at times been of concern to other countries, most notably, Japan, when I was there a year and a half ago when there was considerable discussion in the news media about the possibility that the United States was going down the CFC phase-out route because U.S. industry had identified substitutes that were likely to be profitable and lucrative and to increase market shares.

I would not for a minute suggest that, that is the basis for our position. Obviously, the science makes clear that it has quite another basis, but in fact, it is true that industry, to the extent that it has taken this problem as seriously as it has, has made major investments in substitute technology, research, and development, and is in a good position economically to move into the next era, which for every reason, environmental and economic, we want to see happen.

I think it is precisely right that we have other opportunities. As we lead—I have a sense that in so many areas, quality is demandled.

For instance, the Swiss have newspapers that are better turned out and better quality in many respects, not for what is in them, but for the physical characteristics of them, because the Swiss consumers are apparently compulsive about this aspect of getting the newspapers. As a consequence, the Swiss industry has created a very significant export market in this technology.

I suspect that the same is true in many areas of technology and industry. I believe that as we lead in the environment, it will be one of them.

Senator BAUCUS. Thank you very much.

Senator Lieberman.

Senator LIEBERMAN. I have no further questions.

That is a very optimistic note on which to end.

Senator BAUCUS. I would like the EPA to follow up on this. One of your charts was "EPA Studies—the First Step." You had additional work that remains to be done, and I wonder if you could indicate to us the degree to which EPA is working in each of those six different areas where additional work is needed to be done, and how this committee can help you do that additional work.

Mr. REILLY. Thank you, Senator. I am going to ask that Linda Fisher respond to that question.

Ms. FISHER. Senator, the first bullet is to obtain feedback on our report from the SAB and others. We put it into interagency review and gave it to the other Federal agencies that have an interest in this problem or are directly affected by it. We have given them about six weeks to get back to us.

Additionally, we sent it out to our Science Advisory Board, and they will be meeting with us the first week of April to give us their

comments. We will incorporate those in a final draft and send that to be the official presentation to Congress for the report.

In terms of further work on technologies, costs, and investment strategies, my office has already begun additional work in those areas to look at technologies and to do more cost analysis. Additionally, last year in the Appropriations Bill, the Congress appropriated $700,000.

There were two appropriations of $700,000. One was to look at technologies, and it was given to the National Academy of Engineering through the Department of Energy. The second one was for additional work on policy, and it was given to the EPA. We will be working with the National Academy of Sciences on that.

The third bullet is to analyze domestic and international implementation options. We are working in the intergovernmental arena through the IPCC, the panel that was established by UNEP to do work on the barriers to implementing policy options around the world. In other words, will we need legislation in the various countries? Will we need market forces, such as increased prices or taxes? What kind of social and other economic barriers are countries going to face as they try to implement the different options that we analyzed along with others that other countries might look at?

If we are going to look internationally, we need to figure out what problems people are going to face in trying to implement options. That work is being carried on by the panel, and EPA is very active on that.

In terms of further work on research, again, we are working with the other agencies domestically. There is a lot of work going on at EPA, DOE, NASA, and NOAA on oceans, clouds, biological and other climate feedback. Additionally, through the intergovernmental panel under UNEP, there is a science assessment currently underway that all the governments are participating in, and that panel will also identify additional research needs that need to be done internationally.

We will have international science assessments done, which I think was instrumental in helping get the Montreal Protocol moving forward. It was governments working together and agreeing on science. We are utilizing the intergovernmental panel to the maximum extent that we can.

In terms of a domestic policy, the Domestic Policy Council is working as a unit to deal with climate change. There are so many government agencies that are involved in this, directly through the research program and through their own policy and regulatory programs, that it is essential that we all work together. At this time, the Domestic Policy Council has been the focal point for coordinating all of the agencies to work to develop both the research and the analytical work that needs to be done and ultimately, any policy recommendation that the Administration will have.

Senator BAUCUS. When is your final product going to be in?

Ms. FISHER. The final draft of this report that we have just presented to you?

Senator BAUCUS. Yes.

Ms. FISHER. It will be out, optimistically, in May or June. If all the agencies respond to us in a timely way and the Science Adviso-

ry Board responds in a timely way, then it will take approximately another month to incorporate their views.

Senator BAUCUS. I want to thank you all.

This is a very important step—certainly not the last of the many steps that we will be taking.

This committee looks forward very much to continuing to work with you, Mr. Reilly, and the EPA in the development of solutions for these problems. Thank you very much for being here today.

Mr. REILLY. Thank you, Mr. Chairman.

Senator BAUCUS. The hearing is adjourned.

[Whereupon, at 11:17 a.m., the subcommittee was adjourned.]

[Mr. Reilly's written statement, responses to additional questions from Senator Lautenberg, and Policy Options For Stabilizing Global Climate, Fact Sheet follow:]

TESTIMONY OF
WILLIAM K. REILLY
ADMINISTRATOR
U.S. ENVIRONMENTAL PROTECTION AGENCY
BEFORE THE
SUBCOMMITTEE ON ENVIRONMENTAL PROTECTION
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
UNITED STATES SENATE

March 17, 1989

Mr. Chairman and Members of the Subcommittee, I am very pleased to be given this opportunity to discuss with you the results of my recent activities concerning protection of the global environment, as well as the Environmental Protection Agency's draft report entitled, Policy Options for Stabilizing Global Climate.

Global Environment Activities

We have made excellent progress on the stratospheric ozone issue over the last several weeks. As I am sure you are aware, the President announced his support of a phase out of chlorofluorocarbons by the year 2000 provided that safe substitutes are available, and I was able to take that position with me to Prime Minister Thatcher's London Conference on Saving the Ozone Layer.

That conference was an extraordinary event. To my knowledge, there has not been an environmental conference that involved so many countries -- over 120 in all, 80 at the ministerial level -- since the United Nations Conference on the Human Environment in Stockholm in 1972. The London conference

is probably the single most important international environmental conference since that day, and as you know, it was the Stockholm conference that launched the international environment as a significant issue in many, many countries.

The London conference allowed us to share the latest in scientific research with a full spectrum of countries, including those that were not knowledgeable and those that were skeptical. It allowed all nations to hear of the rapid technological progress that has occurred since the Montreal Protocol was adopted in September of 1987. And, finally, it allowed us to share our views on some of the challenges that will face us over the next decade as we manage the transition to a CFC-free world.

Most gratifying was the response to the Montreal Protocol and to calls to strengthen its control measures. Thirty-six countries have now ratified the agreement, and an additional 20 announced at the Conference that they were actively involved in the ratification process. Ten more countries stated that, as a result of the information they received at the Conference, they would return home to urge active participation in the Protocol. This is most encouraging.

Equally encouraging were the statements of much of the developed world in favor of a phase out of the chemicals that deplete the ozone layer. The European Community announced its position of a phase out of CFCs by the turn of the century, and similar views have been expressed by each individual European country, the Nordic countries, and several of the developing

countries that are parties to the Protocol. This will help us to move forward together quickly to revise the control provisions of the international agreement.

The Administration will work to achieve worldwide ratification of the Montreal Protocol. Actions taken by the developed countries to protect the ozone layer are not sufficient; we must assure that all countries join together in this effort.

During the Conference, I met personally with the delegations of China, India, Brazil, Sri Lanka and other developing countries. The needs of the developing world for financial assistance are very real and very important, and I came away from the meeting with the conviction that we must move positively to deal with these concerns. As you may know, we have already begun to work with the World Bank on this issue, and are encouraged by their initial response. We are also exploring new directions with other multilateral and bilateral aid agencies, and hope to have some concrete suggestions for the developing world at the first meeting of the Parties to the Protocol that will be held in Helsinki in May.

The Helsinki meeting will, I believe, move the process of reconsideration of the Protocol even farther. The Montreal Protocol requires that four assessments be completed before the Parties make decisions to change specific control provisions. These four assessments, one on atmospheric science, one on environmental effects, one on technology, and one on economics,

have already begun. In Helsinki, we will hear from the lead countries on the progress they have made on these assessments. We have every expectation that they will all be completed as scheduled in August of this year, and that a meeting can be held in September for a group of the Parties to prepare recommendations for amendments to the Protocol's control provisions. As the Protocol requires, the recommendations will be circulated to all the Parties, and a decision on strengthening the Protocol can be made at the second meeting of the Parties that is scheduled for April of 1990.

But the Helsinki meeting will be important for other reasons as well. I believe very strongly that managing the transition to substitute chemicals and processes is of critical importance. We must be sure that in our effort to move expeditiously to eliminate the production and use of the controlled substances, we do not create other environmental problems. Our concerns for toxicity, global warming, and the total protection of the ozone layer are all important, and we hope to discuss each of these concerns at the meeting in Helsinki.

It is critical that we take every precaution to ensure that the substitutes for CFCs and halons are not toxic. In the United States, we have authority to require comprehensive testing and analysis of the new chemicals under the Toxic Substance Control Act. We intend to use that authority where it is appropriate.

We also must be sensitive to the close connection between CFCs and global warming. In reducing our dependence on CFCs and halons, we must ensure that new technologies do not result in decreased energy efficiency. While the primary purpose of the Montreal Protocol is to protect the ozone layer, reducing CFC emissions may also have the added benefit of slowing the growth in greenhouse gases that contribute to global warming. According to our current estimates, a phase out of CFCs might reduce the amount of global warming by as much as 15 percent. However, if the CFC substitutes result in less energy efficient products, fossil fuel usage, which contributes to greenhouse gas emissions, would increase. Therefore we must ensure that in shifting from CFCs, we do not have an equally adverse effect on this critical global environmental problem.

Finally, we must be sure that our actions effectively respond to the threat of ozone depletion. That means carefully examining the issue of how much chlorine and bromine the atmosphere can safely absorb. This may be the most difficult challenge we face. We will have to balance the need to eliminate the most harmful ozone-destroying chemicals with the recognition that some of their replacements are likely to contribute small amounts of chlorine to the atmosphere, and that their use may be necessary at least for some period of time. We must also consider whether limits are warranted on other chlorine-containing compounds, such as carbon tetrachloride and

methyl chloroform, which are not now covered by the Protocol's control provisions.

The agenda for the meeting in Helsinki is, as you can see, a very full one. Over the next several weeks, we will be discussing our analyses of these critical issues with industry and with the environmental community. Our interest, like yours, is to see that we move both as quickly and as prudently as is possible. We hope to work with you as we move forward on this path to protect our fragile environment.

Policy Options for Stabilizing Global Climate

CONGRESSIONAL REQUEST FOR REPORTS ON GLOBAL CLIMATE CHANGE

The Committee requested in 1986 that EPA develop two reports on global warming. One report was to focus on "Policy options that if implemented would stabilize current levels of greenhouse gas concentrations." The second report was to examine "The potential health and environmental effects of climate change including, but not be limited to the potential impacts on agricultural, forests, wetlands, human health, rivers, lakes, estuaries as well as societal impacts."

In response to the Congressional Directive, EPA prepared a draft report entitled, Policy Options for Stabilizing Global Climate that I will discuss today. This report investigates technological and policy options for stabilizing and reducing greenhouse gas emissions.

The draft EPA Report is a first attempt to comprehensively analyze alternative policy options to limit greenhouse gas emissions on a global basis. This study has been conducted over the past two years and has been a major undertaking for us. I am quite pleased with the product. At the same time, I must caution the Committee and the public at large, that this is, in fact, a draft study. While various experts within the government and outside have participated in the study, it has not yet been peer reviewed by the Agency's Science Advisory Board or by the experts in other Federal agencies and it is quite clearly subject to change.

THE STABILIZATION REPORT

This report is the result of a major two-year study of the policy options available to stabilize current levels of atmospheric greenhouse gas concentrations. The study produced a comprehensive summary of estimated greenhouse gas sources and trends in concentrations. The major sectors contributing to emissions (energy, industry, agriculture and forestry), and the major greenhouse gases (CO_2, CH_4, N_2O, and CFCs) are considered on a global basis. The study examines various domestic and international policy options that, if implemented, could slow the buildup of greenhouse gases which may contribute to global climate change, including the phasing out of CFCs, halting deforestation and initiating reforestation, increasing use of natural gas, increasing energy efficiency in transportation,

buildings and industry, and developing non-fossil fuel technology. The primary focus of this review is to identify policy options that appear promising. The report has not made a detailed assessment of the costs and other economic aspects of these options. It was impractical to complete such an assessment in this report. However, we view cost and other economic considerations to be of major importance. As part of an international effort, options must reconcile the requirements for both sustainable economic development and a safe environment. Therefore, they should be as cost-effective as possible. The report also suggests future research activities that would improve our understanding of the sources of greenhouse gases and areas where technological improvements would reduce the emission of these gases.

Sources of Greenhouse Gases

Many diverse sources have contributed to the increase in greenhouse gas concentrations, including the burning of fossil fuels, deforestation, and, over the past 40 years, the use of synthetically produced chlorofluorocarbons (CFCs). CO_2 is currently a significant greenhouse gas, responsible for about half of our current increases in our commitment to estimated future warming, but many other gases contribute to global warming-- CFCs, methane (CH_4), and nitrous oxide (N_2O).

All greenhouse gases have multiple sources. The primary anthropogenic sources of CO_2 are fossil fuel combustion and

deforestation. Major methane sources are rice production, enteric fermentation in domestic animals, biomass burning, fossil fuel production, and anaerobic decomposition in landfills. Major N_2O sources are nitrogenous fertilizer use, land clearing, biomass burning, and fossil fuel combustion.

Greenhouse gases are emitted in both the developed and less developed countries. Scientists currently estimate that approximately three-quarters of CO_2 emissions from anthropogenic sources come from the burning of fossil fuels, and one-quarter results from deforestation -- largely in tropical countries. Western Europe and North America account for approximately forty percent of fossil fuel emissions, but since the early 1970s, their emissions have remained relatively stable. In fact, the United States' fraction has been decreasing. The Soviet Union and Eastern Europe, the People's Republic of China, Pacific rim countries and developing countries contribute approximately sixty percent of fossil fuel emissions. And, most importantly, their share is rising. With regard to other greenhouse gases, approximately three-quarters of the CFCs are produced in North America and Europe, while major anthropogenic sources of methane are associated with rice production in Asia. Thus, all countries contribute to greenhouse gas emissions and share some responsibility for their continuing growth.

Study Design

EPA established several program goals in developing the "Stabilization Report": (1) assemble data on global trends in emissions and concentrations of greenhouse gases; (2) develop an integrated analytical framework to study how economic, policy and scientific assumptions influence warming estimates; (3) identify promising technologies and practices that have the potential to limit greenhouse gas emissions; and (4) identify policy options that could slow the buildup of greenhouse gases which may contribute to climate change. To achieve these goals, EPA conducted an extensive literature review and data gathering process. The Agency held several informal panel meetings, and enlisted the help of leading experts in the governmental, non-governmental, and academic research communities. EPA also conducted five workshops to gather information and ideas regarding factors affecting atmospheric composition and options related to greenhouse gas emissions from agriculture and land-use change, electric utilities, end-uses of energy, and developing countries. Experts from NASA, the Department of Energy and the Department of Agriculture were consulted.

Based on the results of this process, EPA developed an integrated analytical framework to organize the data and assumptions required to estimate (1) emissions of radiatively and chemically active gases; (2) concentrations of greenhouse gases; and (3) changes in global temperatures. The framework, though highly simplified, permits alternative assumptions to be

made concerning population growth, economic growth, technological change, and emissions reduction strategies.

In developing our report, we recognize that many factors will influence future greenhouse gas emissions, including rate of population growth, economic growth, technological change, fuel mix, and energy, industrial and agricultural policies. To broadly account for these factors, EPA developed four scenarios of possible future worlds for analysis. Two scenarios assume that no policies are adopted to reduce the emission of greenhouse gases--one assumes that future economic growth and technological change are rapid (Rapidly Changing World or RCW) and one assumes economic growth and technological change are slow (Slowly Changing World or SCW). Both of these scenarios have analogous counterparts which assume that stabilizing policies are adopted (RCWP and SCWP).

Limitations and Uncertainties

This analytical framework models some of the major processes that will influence the rate and magnitude of greenhouse gas accumulation during the next century within a structure that is suitable for policy analysis. There are however, a number of major limitations to this framework. First, assumptions are made in the framework about rates of economic growth and technological change, which strongly influence forecasts of future greenhouse gas emissions. But economic growth and technological change are difficult to

forecast. Second, detailed economic and cost analyses were not conducted. We did not attempt to calculate the macroeconomic impacts of policy options or the total costs associated with various strategies. However, promising technologies were qualitatively screened based on judgments of their expected cost-effectiveness. Third, limitations on capital investment were not explicitly considered. Fourth, economic feedbacks are not fully represented. Finally, our attempts to depict the ocean, changes in atmospheric chemistry, and biogeochemical feedbacks are highly simplified. In summary, we attempt to present our results with all of the uncertainties about the economic system and physical climate system fully recognized.

GENERAL CONCLUSIONS

Uncertainties regarding the magnitude and timing of climatic change are large, but there is a growing consensus in the scientific community that global warming, perhaps of significant degree, due to anthropogenic emissions of greenhouse gases is probable, and rapid climatic change over the next century is possible. Within EPA's scenarios, if no policies to limit the emission of greenhouse gases are undertaken, the equivalent of a doubling of CO_2 is estimated to occur between 2030 and 2040, and the earth warms by 2-6°C by the end of the 21st century.

Very large reductions in anthropogenic emissions would be necessary to stabilize atmospheric concentrations of greenhouse gases. EPA's scenarios do not achieve these reductions, but rather examine a mix of policy responses to limit emissions of greenhouse gases that could significantly reduce the estimated rate and magnitude of climate warming.

Policy and technological measures to limit greenhouse gas emissions are estimated to decrease the magnitude and speed of projected global warming, regardless of uncertainties about the response of the climate system. With such global policy measures, the report estimates that the rate of global warming could be significantly limited over the next century, perhaps by one half or more of the warming that is estimated to occur without policy intervention.

Global cooperation will be essential to effectively reduce greenhouse gas emissions. No single country or source will contribute more than a fraction of the greenhouse gases that may contribute to global climate change. Any overall solution to the climate change problem will require cooperation of many countries and reductions in many sources. For example, postponement of action by developing countries to reduce greenhouse gas emissions would severely hamper the effectiveness of any reduction by developed countries.

The report considers a wide range of potential policy options to reduce greenhouse gas emissions. Although detailed economic analysis was not conducted, we believe that some

emissions reductions are possible while promoting economic development, environmental, and social goals. In industrialized countries, acid rain, urban ozone, and dependence on imported energy could be reduced as part of an overall strategy that reduces greenhouse gas emissions. Energy efficiency improvements are important all over the world. In some developing countries efficiency improvements may actually reduce capital requirements in the power sector and encourage long term economic development. Carefully designed efforts to halt deforestation in developing countries could possibly provide long-run economic and environmental benefits, in addition to reducing the emission of greenhouse gases.

Technological and Policy Options

Various technological and policy options were evaluated for their estimated effectiveness in reducing the projected rate and magnitude of global warming. No single technology or policy can have a significant impact in mitigating the accumulation of greenhouse gases because of the wide variety of sources. But, the models predict that many individual measures, each having a modest impact on greenhouse gas emissions, can have a significant impact on the estimated rate of climate change when combined. The model results imply that only by aggregating the effects of many technical opportunities over a long time can significant reductions in greenhouse gas emissions be achieved. This implies that any overall strategy to reduce greenhouse gas

emissions must seek the right combination of pricing, regulation, technological development, procurement, state programs, and information transfer.

Let me speak about a few of these options. Although we have not conducted detailed economic estimates, there is an extensive literature indicating that improvements in end-use-energy efficiency provide the best option for reducing CO_2 emissions over the next few decades. Reductions in energy use would also reduce emissions of CH_4, N_2O, NO_x, and CO. Many efficiency improvements are possible by the year 2000. These include improvements in the transportation sector, accelerated improvements in building shells, lighting, space conditioning and appliances. All of these could significantly reduce energy requirements.

Near-term reductions in greenhouse gas emissions from electricity generation are possible through both efficiency improvements and fuel switching. Improved fossil electricity generation technology, such as advanced combustion turbines and cogeneration, can increase the efficiency of using these fuels by up to 25 percent. Also, the use of more natural gas to displace coal as a fuel for generating electricity could reduce CO_2 emissions by a substantial amount in the near term.

Alternative fuels, such as hydroelectric, biomass, solar, geothermal, wind, and nuclear, do not emit significant amounts of greenhouse gases and could make an important contribution to reducing these emissions in the medium term and could virtually

eliminate many categories of emissions over the long term. For widespread use of alternative fuels, important engineering, economic, environmental and social issues must be resolved.

Reforestation may offer one of the most attractive options for reducing net CO_2 emissions. Preliminary estimates of the feasibility of large-scale reforestation suggest that with aggressive reforestation programs, the current deforestation trend could be reversed and that a significant net increase in forest biomass is possible.

Improvements in agricultural production efficiency could reduce emissions from those sources. Increasing the efficiency of fertilizer use, productivity of livestock systems, and productivity of rice cultivation could decrease the emission of greenhouse gases per unit of agricultural product. Also, reducing the amount of biomass burning associated with agriculture through sustainable agriculture and effective utilization of crop residues would reduce the emission of greenhouse gases.

According to our current estimates, a phase out of CFCs could reduce the amount of global warming by as much as 15 percent.

Research Needs

The Report defines the major uncertainties relating to climate change, and indicates research needs to both resolve these uncertainties and reduce greenhouse gas emissions. The

Administration is moving ahead to expand research in this area. The President's Budget requested increased resources for a directed and coordinated global change research program. The report suggests that future research activities focus on the characterization of sources of greenhouse gases, climate system feedback analysis, and development of improved ocean circulation models. In addition, research and development is needed to improve our options for limiting greenhouse gas emissions. There is a need for the development of new technologies in the areas of CFC substitutes, energy efficiency (including lighting, industrial processes, vehicles, and insulating materials), alternative fuels (biomass, solar, nuclear, hydrogen, and energy storage techniques), agricultural practices (livestock management, rice production, and biomass burning), and forest management.

NEXT STEPS

As more countries recognize that no single nation acting alone can decisively affect the greenhouse gas problem, international organizations have increasingly become involved in the climate change arena. These include the United Nations Environment Programme (UNEP), the World Meteorological Organization (WMO), and the International Council of Scientific Unions (ICSU). The most significant recent event has been the

establishment by WMO and UNEP of the Intergovernmental Panel on Climate Change (IPCC).

The first meeting of the IPCC was held in November 1988, with over 30 countries participating. The IPCC established three working groups to 1) assess available scientific information on climate change; 2) assess the possible environmental and socio-economic impacts of climate change; and 3) formulate possible response strategies. The working group on science is chaired by the United Kingdom. The working group on impacts is chaired by the Soviet Union. And, the United States chairs the working group on response strategies.

In late January 1989, the United States hosted the first meeting of Working Group III. The meeting was introduced by Secretary of State James A. Baker III, who made four points: first, that we can probably not afford to wait to resolve all uncertainties before acting; second, that we should focus immediately on steps which are justified for other reasons, including reduction of CFC emissions, greater energy efficiency, and reforestation; third, that global solutions should be as specific and cost-effective as possible; and fourth, that solutions must reconcile the requirements for both economic development and a safe environment. The three day session ended with the adoption of an ambitious work plan. The plan includes the development of adaptive and emission limiting responses for agriculture, industry, natural resources, and coastal zones. The EPA was an active participant in this entire process along

with other agencies. The Agency expects to play a very active role in the IPCC process in the future.

EPA, along with other Federal agencies, intends to continue to be an active participant in the formulation of a Federal research agenda, in the conduct of research that improves our understanding of the earth's climate system and that supports the needs of policymakers, and in future debates over strategies to adapt to climate change or to limit emissions.

The development of a national policy, as mandated under the Climate Protection Act, will be complex and the formulation of a coordinated international response may take a great deal of effort. Much work remains to be done by the research community to understand emissions, the interactions of emissions with the biosphere, and the ultimate effect on man and the environment of increasing greenhouse gas emissions levels in the atmosphere. At EPA, we intend to examine the prudent steps that can be undertaken to achieve multiple goals, and do so in a timely manner. In the future, we will do a great deal more to examine the cost of different options and the technological, cultural, and political barriers to implementation of policies. EPA looks forward to working with interested federal agencies, and others, and to the exchange of research and policy findings with other countries.

Mr. Chairman, thank you for your invitation to present testimony before the Committee. This has been a welcome opportunity to discuss EPA's efforts on this important and complex issue. I would be pleased to answer any questions you may have.

United States
Environmental Protection
Agency

External Affairs (A-100AE)
Washington DC 20460

EPA

Legislative Analysis

APR 24 1989

Honorable Max Baucus
Chairman, Subcommittee on Environmental Protection
Committee on Environment and Public Works
U.S. Senate
Washington, D.C. 20510

Dear Mr. Chairman:

Enclosed, for insertion in the hearing record, are EPA's responses to questions which you forwarded on behalf of Senator Lautenberg following the March 17 hearing concerning global warming.

Please feel free to contact us if we can be of any further assistance.

Sincerely yours,

Barbara Blumenauer

for A. Henry Schilling
Director, Office of
Legislative Analysis

Enclosure

1. In your opinion, what is the likelihood of achieving an international agreement to phase out the use of ozone-depleting chemicals by the year 2000?

The likelihood is good that the international community will amend the Montreal Protocol to require a complete phaseout by the year 2000 of ozone-depleting chemicals. The current schedule of the United Nations Environment Programme (UNEP) calls for a meeting of the parties to the Protocol in April 1990 when a decision on the adoption of more stringent controls on CFCs and halons will occur.

European and North American nations -- major world producers of CFCs and halons -- are already calling for a complete phaseout of ozone-depleting chemicals. Shortly before the London Conference on the Ozone Layer in March this year, the European Community announced a consensus among its 12 members for a complete ban on production of CFCs by the year 2000. Both the United States and Canada also made similar announcements. The Nordic countries (Norway, Sweden and Finland) are calling for a complete phaseout earlier than 2000. The phaseout of ozone-depleting chemicals will occur consistent with the development of safe and effective chemical substitutes.

The largest CFC producer in the U.S. last year announced the intention to end production of controlled substances by the year 2000, dependent on the development and approval of chemical substitutes and alternative processes.

Currently, 33 nations are parties to the Protocol, which entered into force January 1. These nations represent more than 80 percent of the world's consumption of CFCs and halons. Twenty other nations have indicated their willingness to participate and are expected to ratify this year.

2. What are the major obstacles to achieving such an agreement?

Some developing countries are hesitant to join the Protocol or agree to a complete phaseout until chemical substitutes become available and, more critically, until mechanisms for the transfer of CFC and halon alternatives are more clearly defined. Lack of more specific means of technology transfer is an obstacle in encouraging certain nations to join the Protocol; e.g., India and China. Some concerns of these nations are: Will the actual technology to produce substitute chemicals be available on attractive terms? Will a nation become dependent on such imports, or will production facilities be built abroad? What cost must a developing nation bear to retrofit manufacturing facilities that use CFCs and halons? Who will bear these costs?

Furthermore, the Soviet Union appears to have some continued doubts about the validity of scientific research on the depletion of ozone. For example, the Soviets have suggested that factors other than CFCs and halons may be contributing to ozone destruction over the Arctic.

Japan is the only other major developed nation that has not announced its support for a phaseout. It is concerned that appropriate substitutes may not yet exist for all CFC and halon uses and is therefore reluctant to support a phaseout.

3. What impact would unilateral action at this time by the U.S. to phase out such chemicals have on reaching such an agreement?

Unilateral action by the United States at this time would likely be counter-productive. The assessment process as required under the Montreal Protocol is already underway: Four panels of experts are formed to review new developments in environmental, economic, scientific and technical research; a Committee of Parties will integrate the reports of the panels and make recommendations for Protocol changes. Based on these assessments, a meeting of the Parties in April 1990 will likely make amendments to the Protocol to further restrict use of CFCs and halons. U.S. support of the assessment process and its call for a complete phaseout of controlled substances through the Protocol review process are the most prudent actions at this time and will likely result in the broadest participation in the Protocol.

4. When do you expect to complete both of your draft global warming reports to Congress?

The draft report on "Potential Effects of Global Climate Change on the United States" has been reviewed by EPA's Science Advisory Board (SAB) and detailed comments have been received from the Departments of Agriculture, Energy, Interior, NOAA and NASA, among other agencies. Incorporation of these comments is almost complete. The report will then go into final executive branch review, with formal presentation to Congress expected in early summer. The draft report "Policy Options for Stabilizing Global Climate" was reviewed by EPA's Science Advisory Board on April 4-5, and Agency comments have been requested by April 21. It is difficult to anticipate how long it will take to incorporate comments, but we hope to present the final report to Congress this summer.

5. What plans does the Administration have to develop policies to address global warming? When does the Administration plan to submit legislation to Congress dealing with policies to address global warming?

The United States Government is working actively to develop a policy on climatic change both internationally and domestically. Internationally, we are playing a leadership role in the Response Strategy Working Group of the Intergovernmental Panel on Climate Change (IPCC) established by UNEP and WMO. Domestic policy development will be tied in closely with the work of this group which will complete its first report by the end of 1990. Domestically, the Climate Protection Act requires the President, through EPA, to coordinate the development of national policy. The EPA will work through the Domestic Policy Council on issues relating to climate change. As stated by Secretary of State Baker in his address to the IPCC, the U.S. can take steps to limit greenhouse gas emissions, which can be justified for other reasons, such as to reduce CFCs, encourage reforestation, and increase energy efficiency. EPA will bring issues to the Council in those areas. (The President has already announced his support for a global CFC phaseout, subject to the availability of safe substitutes.) We feel that the most prudent approach would be to play an active role in the IPCC and let it complete its work. As the work of EPA and other federal agencies progresses, the Administration will be in a better position to assess possible legislative options.

6. Your latest report says that addressing global warming also results in reducing acid rain and ozone pollution. How are you incorporating the findings in this report into the legislation your are developing to address urban ozone and acid rain?

EPA is currently investigating mechanisms for reducing energy use, and modelling the collateral reductions in emissions of greenhouse gases and the precursors to acidic deposition and tropospheric ozone. This analysis will be included in the evaluation of various alternatives for reducing urban ozone and acidic deposition.

7. What are the prospects for achieving an international agreement to address global warming?

The historic Montreal Protocol on Substances that Deplete the Ozone Layer is a very important precedent demonstrating that international action to protect the global environment is possible. In fact, because CFCs are greenhouse gases as well as ozone depleters, the Montreal Protocol is an agreement that addresses global warming. On the other hand, a comprehensive agreement on global warming, or specific agreements dealing with other greenhouses gases (such as carbon dioxide, methane, and nitrous oxide) may be much more difficult to achieve. This is because the activities giving rise to other greenhouse gas emissions (e.g., energy use and agriculture) are more pervasive and fundamental to the functioning of societies than those that result in CFC emissions. A range of options exist, ranging from a comprehensive greenhouse gas agreement, to gas-by-gas agreements, to activity-by-activity agreements (eg. appliance efficiency, automobile efficiency, automobile efficiency, cooperative research and development). The goal of the IPCC process is to help foster the development of an international consensus on the scientific issues associated with global warming, the impacts of climate change, as well as on possible policy responses. Advances in international understanding of these issues are necessary before an international agreement can be reached.

FACT SHEET
March 1989

POLICY OPTIONS FOR STABILIZING GLOBAL CLIMATE

DRAFT

REPORT TO CONGRESS

U.S. Environmental Protection Agency

Office of Policy, Planning, and Evaluation

ABSTRACT

At the request of Congress, EPA conducted a major study of the policy options available to stabilize current levels of atmospheric greenhouse gas concentrations. This two year effort produced a comprehensive summary of greenhouse gas sources and trends in concentrations. The major sectors contributing to emissions (energy, industry, agriculture, forestry), and the major greenhouse gases (carbon dioxide, chlorofluorocarbons, methane, nitrous oxide) are considered on a global basis. The influence of economic, policy, and scientific assumptions on future warming estimates are studied using an integrated framework. Promising domestic and international policy options that could slow the buildup of greenhouse gases and global warming are evaluated, including: phasing out CFCs, halting deforestation and initiating reforestation, increasing energy efficiency in transportation, buildings, and industry, placing a carbon emission fee on fossil fuels, and developing non-fossil fuel technology. Adopting policies immediately to begin slowing the buildup of greenhouse gases could reduce warming over the next century by at least 60%.

What is the Greenhouse Effect?

- Visible light from the sun strikes the Earth, warming the surface; infrared energy is radiated back toward space
- A blanket of greenhouse gases in the atmosphere absorbs infrared energy, and re-radiates it in all directions, warming the lower atmosphere
- Greenhouse gases that occur naturally, are in large measure responsible for making the Earth a habitable planet; without them average temperatures would be about freezing

Why is There Concern about the Greenhouse Effect?

- Concentrations of greenhouse gases are increasing as a result of human activities
- CO_2 concentrations have increased about 25% since preindustrial times; Methane concentrations have more than doubled during the last two centuries; Other trace gas concentrations (CFC's, N_2O, Tropospheric Ozone) are also increasing
- Uncertainties regarding climatic change are large, but there is a growing consensus in the scientific community that significant global warming due to anthropogenic emissions of greenhouse gases is probable, and rapid climatic change over the next century is possible.

The Greenhouse Gases

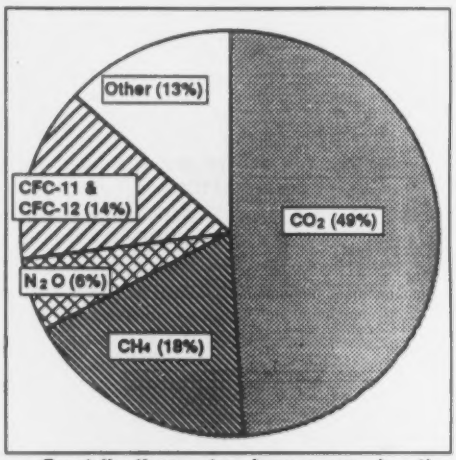
The climate warming potential of different greenhouse gases depends upon the properties of the gases and changes in their atmospheric concentrations. Carbon dioxide (CO_2) is currently the most significant greenhouse gas, responsible for about half of current increases in the greenhouse effect, but many other gases contribute to global warming -- chlorofluorocarbons (CFCs), methane (CH_4), nitrous oxide (N_2O). The figure below shows the relative contribution of each gas in the 1980s.

Carbon Dioxide (CO_2) is increasing at about 0.4% per year, primarily due to fossil fuel combustion and deforestation.

Methane (CH_4) is increasing at about 1% per year. Sources include rice production, enteric fermentation in domestic animals, biomass burning, fossil fuel production, and anaerobic decomposition in landfills.

Nitrous Oxide (N_2O) is increasing at about 0.25% per year, as a result of nitrogenous fertilizer use, land clearing, biomass burning, and fossil fuel combustion.

Chlorofluorocarbons (CFC's) have increased very rapidly this decade (about 5% per year). CFC's are synthetic chemical compounds.

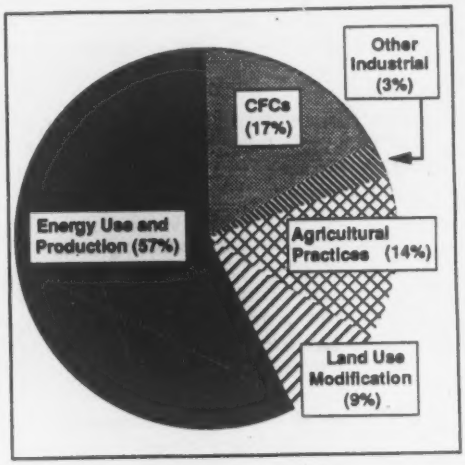


Contributions to Increases in the Greenhouse Effect During the 1980s. Estimated values based on concentration changes.

Sources of Greenhouse Gases

No single country or source will contribute more than a fraction of the greenhouse gases that will warm the world; any overall solution will require cooperation of many countries and reductions in many sources.

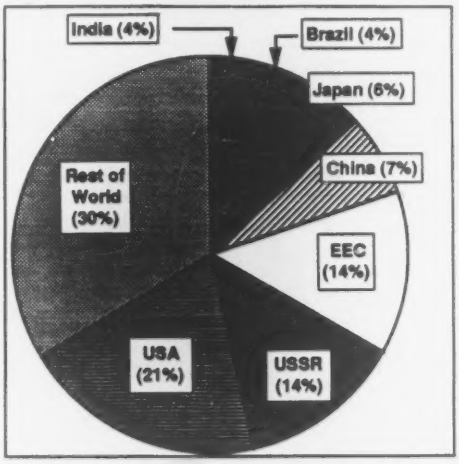
- Energy production and use is the largest anthropogenic source of greenhouse gases, but other activities are also significant.



Relative Contribution of Different Activities to Increases in the Greenhouse Effect During the 1980s. Estimated values based on weighted emissions.

- The U.S. is responsible for about one-fifth of global greenhouse gas emissions. The rest of the OECD, and the East Bloc each contribute a similar amount.

- Greenhouse gas emissions in developing countries are currently very low, but the share of total emissions contributed by developing countries is expected to grow, accounting for more than 50% of global emissions by 2025 in the scenarios analyzed.



Relative Contribution of Different Regions to Increases in the Greenhouse Effect During the 1980s. Estimated values based on weighted emissions.

Current Greenhouse Theory and Uncertainties

Theory and observations suggest that an increase in greenhouse gas concentrations will result in global warming. The rate and magnitude of global warming is uncertain however, because rates of future greenhouse gas emission cannot be predicted, and the Earth's climate system is not fully understood.

- Uncertainties surrounding the uptake of heat and CO_2 by the oceans, the role of clouds, and the impact of changes in sea ice affect estimates of the rate and magnitude of future warming.

- A 1987 report from the National Academy of Sciences assessed what we do and do not know about climate change. It concluded that increases in greenhouse gas concentrations will lead to: Global-Mean Surface Warming (very probable); Global-Mean Precipitation Increase (very probable); Reduction of Sea Ice (very probable), and Rise in Global Mean Sea Level (probable). Changes in regional climate and extreme climatic events are much less certain. Estimates of global mean temperature change are presented in the report as a proxy for climatic change.

- A series of reports by the National Academy of Sciences (in 1979, 1983, and 1987) and a "State-of-the-Art" report issued by the U.S. Department of Energy in 1985 concluded that a doubling in atmospheric CO_2 concentration would most likely eventually result in a 1.5 to 4.5°C increase in global temperature. Recent analyses suggest that a warming of up to 5.5°C is possible for a doubling of CO_2, and when all geochemical and biogenic feedbacks are considered, it is possible that the actual sensitivity of the Earth's climate system to an initial greenhouse gas increase could exceed 5.5°C.

- Global temperatures have increased 0.3 to 0.7°C over the last century. While this increase cannot be definitively attributed to the greenhouse effect, it is consistent with expectations given the uncertain delay caused by ocean heat uptake.

What Congress Asked EPA to Do

> Conduct a study that includes "... an examination of the policy options that, if implemented would stabilize current levels of atmospheric greenhouse gas concentrations. This study should address: the need for and implications of significant changes in energy policy, including energy efficiency and development of alternatives to fossil fuel; reduction in the use of CFC's; ways to reduce other greenhouse gases such as methane and nitrous oxides; as well as the potential for and effects of reducing deforestation and increasing reforestation efforts."

Goals

In responding to the Congressional request, EPA established the following goals:

- Assemble data on global trends in emissions and concentrations of greenhouse gases.
- Develop an integrated analytical framework to study how economic, policy, and scientific assumptions influence future warming estimates.
- Identify promising technologies and practices that could limit greenhouse gas emissions.
- Identify policy options that could slow the greenhouse gas buildup and global warming.

Limitations of Study

- Economic growth and technological change are difficult to forecast
- Detailed cost analyses were not conducted -- technologies were screened based on judgments of their promise to be cost-effective
- Limitations on capital investment were not explicitly considered
- Economic feedbacks are not fully considered
- Modeling of oceans, changes in atmospheric chemistry, and biogeochemical feedbacks is highly simplified
- Analytical framework is not fully integrated

Findings of the Stabilization Report

- Measures undertaken to limit greenhouse gas emissions would decrease the magnitude and speed of global warming, regardless of uncertainties about the response of the climate system.

- A wide range of policy choices is available to reduce greenhouse gas emissions while promoting economic development, environmental, and social goals.

- Very large reductions in anthropogenic emissions would be necessary to stabilize atmospheric concentrations. EPA's scenarios do not achieve these reductions.

GAS	REDUCTION REQUIRED
Carbon Dioxide (CO_2)	50%-80%
Methane (CH_4)	10-20%
Nitrous Oxide (N_2O)	80%-85%
Chlorofluorocarbons (CFCs)	75%-100%
CO, NO_x	Freeze

- If no policies to limit the emission of greenhouse gases are undertaken, the equivalent of a doubling of CO_2 occurs between 2030 and 2040 in the EPA scenarios.

- In these scenarios the Earth warms by 2-6°C by the end of the 21st Century.

- Because the oceans have a large heat capacity, the temperature change realized in the atmosphere lags considerably behind the ultimate warming that can be expected from a given increase in greenhouse gas concentrations.

- The rate of climate change in the Stabilizing Policy scenarios is between 0.6 and 1.4°C per century, or at least 60% less than corresponding worlds without a policy response to potential climate change.

- Delaying adoption of policies to reduce the emission of greenhouse gases until 2010 in developed countries and 2025 in developing countries could increase our equilibrium warming commitment in 2050 by 30-40%.

- If developing countries do not adopt climate stabilizing policies, then the equilibrium warming commitment in 2050 could increase by about 40% compared to scenarios in which there is global cooperation.

Possible Global Policy Responses by the Year 2000

Policy response options vary by country; they include pricing, regulation, technology development, information programs, and government procurement. Measures that might be implemented by 2000 include:

- New automobiles average 40 mpg
- New automobiles in the OECD use 3-way catalytic converters to reduce CO and NO_x (current U.S. standard); rest of world uses an oxidation catalyst
- Average space heating requirements of new single family homes are 50% below 1980 new home average
- Net global deforestation stops
- CFCs are phased out; production of methyl chloroform is frozen
- Carbon emission fees of 20% on coal, 11% on oil, and 7% on natural gas are placed on fossil fuels.
- Research and development into solar technology allows solar to compete with oil and natural gas (DOE long-term policy goals)
- Biomass energy plantations (e.g. short-rotation tree farms) increase productivity 65%

Impact of Stabilizing Policies on Global Warming--Notes

a. CFC Phaseout.

- Complete phaseout of fully halogenated CFCs by 2003 and a freeze on methyl chloroform.
- Full participation in industrialized countries and 94% participation in developing countries.
- No controls on CFC substitutes (HCFCs).

b. Reforestation.

- Reforestation efforts are expanded dramatically starting in 1990 and deforestation halts by 2025. Deforestation is currently estimated to be 10 million hectares per year. The maximum rate of reforestation (which occurs between 1990 and 2015) is 26 million hectares per year; the current rate of reforestation is about 1 million hectares per year.
- The biosphere changes from a net source of about 0.7 billion tons of carbon per year in 1985 to a net sink for CO_2 by 2000.
- Net uptake reaches 0.7 billion tons of carbon per year by 2025.
- One billion hectares are reforested by 2100 (an area roughly equal to the size of the United States; a 25% increase over the current forest area).

c. Improved Transportation Efficiency.

- New car efficiency reaches 40 mpg by 2000. New cars currently achieve 25-33 mpg. A number of prototype cars have been built that achieve 70-90 mpg.
- Global fleet-average automobile efficiency reaches 50 mpg by 2025.
- Significant improvements are assumed in truck, air, and rail efficiency.

d. Other Efficiency Gains.

- The overall rate of efficiency improvement in the residential, commercial, and industrial sectors is 10-40% higher than in the reference case between 1985 and 2025, and 30-40% higher between 2025 and 2100.
- Heating energy use per unit of residential and commercial floor space declines by as much as 75% and electricity use declines by as much as 50% by 2025. The most efficient new homes currently being built use only 30% as much heating energy per unit of floor area as the average existing house in the United States. Prototypes exist that use only 10% of current average energy requirements. Technology is already available to reduce energy requirements for lighting by 75%.
- Advanced industrial processes are available that can significantly reduce the energy required to produce basic materials. For example, new steel production technology uses about half as much energy per unit of steel production as the current U.S. average. Energy use by electric motors, which account for approximately 70% of U.S. industrial electricity use can be reduced by at least 15%.

e. **Energy Emissions Fees.**
   - Emissions fees are phased in on fossil fuels based on their CO_2 emissions potential.
   - By 2025 emission fees amount to 44% on coal, 24% on oil, and 15% on gas.

f. **Promote Natural Gas.**
   - The costs of locating and producing natural gas (at each step on the supply curve) are assumed to decline 0.5% per year more rapidly than in the reference case.
   - The share of fossil energy supplied by gas in 2025 is 26% versus 21% in the reference case and 22% currently. U.S gas use in 2025 is about equal to the 1973 peak level. (Total gas production is actually somewhat lower in the policy case compared with the reference case because of lower total demand and competition with non-fossil fuels, particularly biomass).

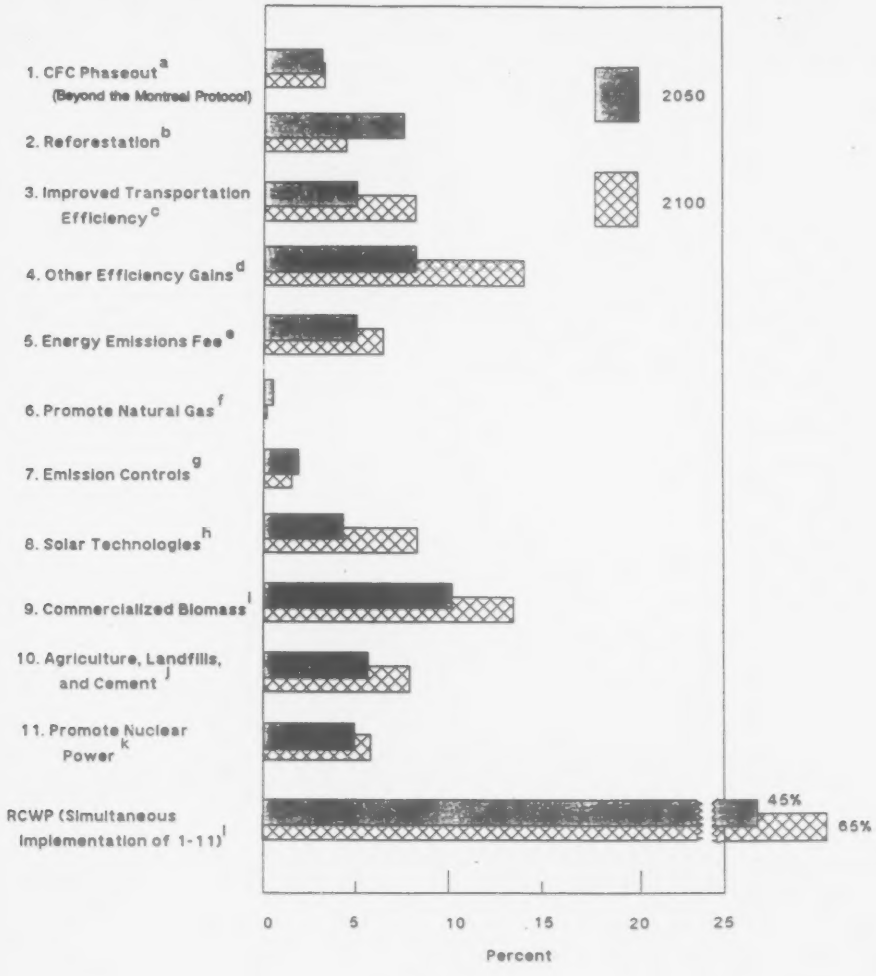
g. **Emission Controls.**
   - All new vehicles use three-way catalysts by 2025 (current U.S. standard).
   - Low NO_x technology (equivalent of Selective Catalytic Reduction) is required in all new combustors by 2025.

h. **Solar Technologies.**
   - The cost of electricity from solar technologies (PV, thermal, wind, etc.) is marginally competitive with electricity from oil and gas by 2000 (DOE goals) and strongly competitive by 2025. Solar photovoltaic (PV) cells are currently competitive for may remote power genertion needs, especially in developing countries. Dramatic progress has been made recently in reducing the costs of producing PV systems, particularly with thin-film amorphous silicon technology. Progress has also been made with solar thermal technology; 600 Megawatts of solar-thermal electrical capacity is currently being constructed under commercial contracts with Southern California Edison. The cost of production is expected to be about 8 cents/kilowatt-hour.
   - Solar supplies 17% of global electricity in 2025 versus 4% in the reference case.

I. **Commercialized Biomass.**
   - The productivity of tree plantations (tons/hectare/year) increases 65% by 2000 and the cost of energy produced from biomass declines about 50% by 2025. Between 2000 and 2100, 380 million hectares of plantations devoted to biomass production are gradually established. This represents about 9% of current forest and woodland area.
   - Biomass-fired combustion turbines and biomass converted to gaseous and liquid fuels supply 21% of primary energy in 2025 versus 1% in the reference case. Currently, traditional uses of biomass, mostly for cooking, account for roughly 10% of global enegy consumption. Tradtional biomass use is extremely inefficient--approximately 10% in typical stoves. This energy use is not included in most tabulations of global energy supplies.

Many Individual Measures, Each Having A Modest Impact on Greenhouse Gas Emissions, Can Have a Dramatic Impact on the Rate of Climatic Change When Combined

Relative Effectiveness of Different Policy Strategies (Percentage Decrease in Equilibrium Warming Commitment)



j. Agriculture, Landfills, and Cement.

- Methane emissions per unit of rice cultivation and domestic animals, and nitrous oxide emissions per unit of nitrogen fertilizer, are assumed to decline by 0.5% per year.
- Gas recovery and recycling are assumed to reduce methane emissions from landfills by 2% per year in industrialized countries; emissions level off by 2025 in developing countries.
- Demand for cement is assumed to be 25% less than in the reference case.

k. Promote Nuclear.

- The cost of nuclear technology declines by 0.5%/yr.
- Nuclear supplies 17% of electricity in 2025 versus 15% in the reference case. Currently nuclear supplies about 15% of electricity.
- Approximately 600 new power plants are built worldwide by 2025 (assuming 1000 MW per plant).

l. RCWP Scenario.

- The Rapidly Changing World with Stabilizing Policies (RCWP) scenario is obtained by applying all of the above assumptions simultaneously to the reference Rapidly Changing World (RCW) scenario.
- The total reduction is not equal to the sum of the individual measures.

Integrated Strategies can Yeild Multiple Benefits

- In industrialized countries, acid rain, urban ozone, and dependence on imported energy could be reduced as part of an overall strategy that reduces greenhouse gas emissions.

- Energy efficiency improvements are already essential in developing countries to reduce capital requirements for the power sector, and efforts to halt deforestation will provide many long-run economic and environmental benefits.

U.S. Leadership can Promote International Cooperation

- U.S. leadership has made important contributions to recent international environmental agreements, such as the Montreal Protocol on Substances that Deplete the Ozone Layer and the Tropical Forest Action Plan.

- The U.S. government is committed to playing a key role in the Intergovernmental Panel on Climatic Change (IPCC) established under UNEP and WMO auspices.

- The U.S. can also promote desirable changes in energy and environmental policy in developing countries through judicious use of its bilateral aid programs and its influence on loans extended by multilateral development banks.

- Domestic initiatives could foster international cooperation by demonstrating a commitment to respond to global climatic change.

Current Government Actions

- o Major research programs being developed by NASA, NOAA, NSF, EPA, and other agencies.

- o Intergovernmental panel on climate change formed by UNEP/WMO to consider science and policy responses. Response Strategies Working Group met in Washington, Jan 30 - Feb 1, 1989. Meeting addressed by Secretary Baker.

Next Steps

- o Science Advisory Board Meeting
- o Formal Interagency Review
- o Transmittal to Congress

Draft Report Availability

The full draft report (three volumes) will be distributed by the Government Printing Office (202 275-3648). Request document number 055-000-00282-7.

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